

Cec;

Thanks,

HEA

1/7/58



INDUSTRIAL TRANSMITTERS AND ANTENNAS
7327-A WEST CHESTER PIKE
UPPER DARBY, PENNA.
FLanders 2-0355

January 7, 1958

A M

7:8

Mr. Cecil S. Bidlack
Television Engineer
National Association of Educational Broadcasters
14 Gregory Hall
Urbana, Illinois

Dear Mr. Bidlack:

Thank you ever so much for your pertinent and
prompt letter. I plan to follow your suggestions.

I look forward to the opportunity of meeting
you on a more personal basis at one of NAEB gatherings.

Sincerely yours,


Bernard Wise

BW/jg

January 3, 1958

Mr. Bernard Wise
Industrial Transmitters and Antennas
7327-A West Cluster Pike
Upper Darby, Pennsylvania

Dear Mr. Wise:

Thanks for your letter of December 30th regarding the formation of I.T.A. for the manufacture of FM equipment for educational broadcasters. Your letter arrived just as copy was being prepared for the January NAEB Newsletter, and, if space permits, mention of your installation at WRTI-WH and of your organization, will be included.

The annual NAEB Convention is held in late October; in 1957 (the 33rd) it was held in St. Louis, October 29 through November 1. Dates for the 1958 Convention in Omaha, Nebraska have not yet been set. No equipment exhibit has been held in connection with this event since the 1954 convention in New York City.

The 28th annual Institute for Education by Radio-Television will be held in Columbus, Ohio May 12-15, 1958. It is usually held at the Deshler Hilton Hotel and last year had a small equipment exhibit, mainly consisting of television equipment. I believe that the exhibitors felt that IERT was quite worthwhile as contrasted to the NAEB Convention in New York where most exhibitors thought the attention paid to the equipment exhibits not adequate for the expense involved.

I would suggest that you write to Dr. I. Keith Tyler, Director, Institute for Education by Radio-Television, Ohio State University, Columbus 10, Ohio for information regarding the 1958 Institute.

The Eleventh Annual Western Radio and Television Conference will be held at the Bellvue Hotel, San Francisco, California February 13, 14 & 15. Region VI of NAEB will also meet there two days prior to this meeting. For information contact Ronald L. Hunt, 3712 Starr King Circle, Palo Alto, California.

There is also an Annual DAVI Meeting to be held in Minneapolis, Minnesota in April, which has an equipment exhibit. For further information contact Miss Mary C. Welch, Department of Audio-Visual Education, National Education Association, 1201 Sixteenth Street, N. W., Washington, D. C. You might inquire of Miss Welch about NEA meetings, having equipment displays.

Mr. Bernard Wise

-2-

January 3, 1958

NAEB would like to see more of the educational FM channels occupied. Since the number of commercial FM stations is growing daily, we believe there is bound to be pressure for the use of some of the reserved channels, especially in the larger population centers. I shall be glad to furnish your name to those inquiring about fm transmitters.

Best wishes for success in your new venture.

Yours very truly,

Cecil S. Bidlack
Television Engineer

CSB:jw

I.T.A.



INDUSTRIAL TRANSMITTERS AND ANTENNAS

7327-A WEST CHESTER PIKE

UPPER DARBY, PENNA.

Flanders 2-0355

RECEIVED
NAEB HEADQUARTERS

December 30th, 1957

Mr. Cecil S. Bidlack
NAEB
14 Gregory Hall
Urbana, Illinois

JAN 2 1958

7 8 9 10 11 12 1 2 3 4 5 6
PM

Dear Mr. Bidlack:

The purpose of this letter is to advise you that our company has been formed by a group of experienced broadcast design and field engineers for the express purpose of providing FM equipment to the educational broadcasters. To date we have had our FM-250 Watt and 500 Watt Transmitters type accepted by the FCC and are in the process of having our 10 Watt and 75 Watt Transmitters approved.

I am attaching photographs of our FM-10 Watt and FM-75 Watt units as well as descriptive literature on our FM-10 Watt and FM-250 Watt Transmitters.

We presently have our first FM-500 Transmitter at Station WRTI-FM, Philadelphia, Pennsylvania. We would like to have the opportunity to display our equipment to the members of your organization. If you have any suggestions of the method by which this can be done, please let me know.

If you should have any further questions, I would be pleased to be of assistance. Thank you very much for considering us.

Sincerely yours,

Bernard Wise
Bernard Wise

P. S. If you should know of any sectional, regional or national conferences in which equipment displays are appropriate, we would appreciate receiving this information.

BW/jg
Encls.

INDUSTRIAL TRANSMITTERS AND ANTENNAS

FM-10A, 10 Watt, FM Broadcast Transmitter

FEATURES

- 1 - DESIGNED PRIMARILY FOR EDUCATIONAL INSTALLATIONS
- 2 - MAY BE OPERATED UNATTENDED
- 3 - MAY BE OPERATED BY REMOTE CONTROL
- 4 - PROVIDES FACILITIES FOR AUDIO SWITCHING
- 5 - HOUSED IN MODERN ARTISTIC CABINET
- 6 - METERS PROVIDED IN TURRET FOR FINAL PLATE VOLTAGE, CATHODE CURRENT, OUTPUT POWER AND INPUT MODULATION LEVEL
- 7 - AUDIO ATTENUATOR PAD PROVIDED ON CONTROL TURRET
- 8 - UTILIZES HIGH QUALITY STANDARD PARTS
- 9 - CONSERVATIVELY RATED FOR CONTINUOUS DUTY
- 10 - CUSTOM TESTED ON CUSTOMER'S CHANNEL
- 11 - MEETS ALL FCC SPECIFICATIONS
- 12 - CAN BE USED IN BUILDING BLOCK ARRANGEMENT TO INCREASE POWER

USES

The FM-10A is a 10 Watt FM Transmitter designed to operate on any fixed frequency between 88 and 108mc. It can be used as an independent unit for transmitting FM intelligence or as a driver for a medium power FM amplifier.

In particular, this unit is ideally suited for low power educational stations, where the coverage of campus and immediate areas are required.

Since this transmitter incorporates audio switching and attenuation features, a minimum of studio equipment will be required to form a complete station.

Since the FM-10A utilizes identical circuitry to that used in higher power commercial transmitters, students can derive technical as well as program experience from its operation.

DESCRIPTION

Electrical

The FM-10A is a crystal controlled phase modulated transmitter. Frequency stability of .001% is assured by utilizing thermostatically controlled crystal heaters. The broad audio frequency response is achieved by utilizing conventional pulse shaping and phase modulating circuits. The RF frequency multipliers are driven into saturation, thus reducing AM hum to a negligible value.

It should be noted that no RF stage acts as an on frequency amplifier. This eliminates the problem of neutralization and assures freedom from parasitics and continuity of programming.

All circuits of the FM-10A can be tuned from the front panel. This ease of tuning plus the availability of meters for every RF circuit permits ease of operation, maintenance and technical analysis. A power output meter on the meter turret gives a direct reading of transmitter output.

Facilities for switching two audio inputs are available. Their levels are adjusted by a front panel attenuator to achieve the desired value on the "modulation meter".

Mechanical

The FM-10A is housed in an attractive custom cabinet and incorporates a modern styled control turret. It requires a floor space of 22 7/8 x 23 1/16".

The transmitter is completely self contained and requires only the installation of tubes, crystal and the connection of audio and power lines before operation can begin.

SPECIFICATIONS

Performance Specifications

Type of Emission	- FM
Frequency Range	- 88 to 108 MC
Rated Power Output	- 10 Watts
RF Output Impedance	- 50 Ohms
Input Impedance	- 600/150 Ohms
Input Audio Level	- ± 10 μ or - 2dbm
Amplitude vs Frequency	- \pm or - 1db from 50 to 15000 cycles
Carrier Frequency Stability	- \pm or - 1000 cycles
Modulation Capability	- \pm or - 100KC
Audio Frequency Distortion	- 1.5% max. 50 - 100 cycles 1.0% max. 100 - 7500 cycles 1.5% max. 7500 - 15000 cycles
FM Noise Below \pm or - 75KC	- 60db
AM Noise, RMS	- 50db below carrier
Harmonic Attenuation (Ratio of any single harmonic to carrier)	- at least 60db

Electrical Specifications

Power Line Requirements	
Transmitter	- 115v/50/60 cycles, 1 phase
Slow Line Variations	- \pm or - 5%
Rapid Line Variations	- \pm or - 3%
Regulation	- 3%
Power Consumption	- 175 Watts (Approximately)
Power Factor (Approximately)	- 90%

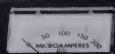
Mechanical Specifications

Transmitter Overall Dimensions	
Width	- 23 $\frac{9}{16}$ "
Height	- 38 $\frac{1}{2}$ "
Depth	- 18 $\frac{1}{2}$ "
Weight	- 200 lbs. approximately
Maximum Altitude	- 7500 feet
Ambient Temperature	- 45°C max. - 10°C min.

Tube Complement

<u>Quantity</u>	<u>Type Number</u>
4	12AT7
1	12AX7
1	12AU7
6	6BH6
1	5763
1	6146
1	5R4GY
2	OD3

FM-10A BROADCAST TRANSMITTER

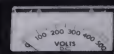


OUTPUT

INTERLOCK

INC

DEC



PA PLATE

PLATE

ON

OFF



PA CATHODE

LINE #1

LINE #1

LINE #2



MODULATION

LINE #2

V



FM-75A BROADCAST TRANSMITTER



LINE



FILE



OUTPUT



INTERRUPT



PA PLATE



FILE



PA CATHODE



FILE



FILE

FILE

FILE

FILE

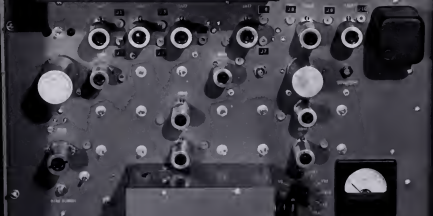
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FILE

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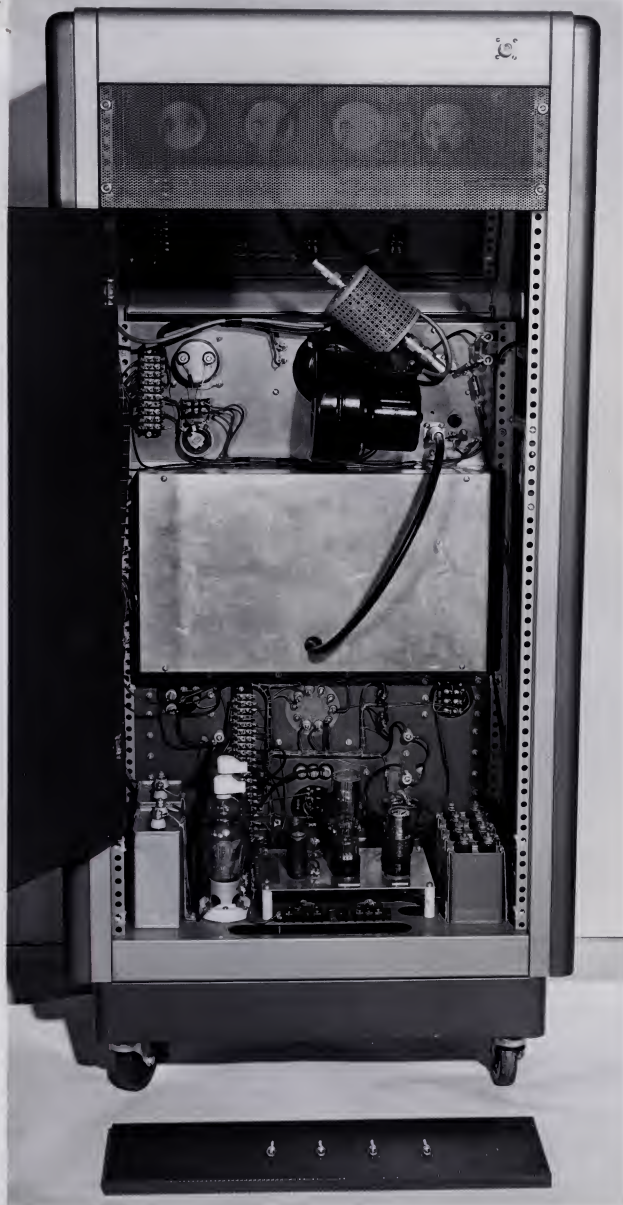


FILE

FILE







FEATURES

- 1 - FCC TYPE ACCEPTED.
- 2 - Designed for unattended operation.
- 3 - Utilizes high quality standard parts.
- 4 - 4-250A in final PA operates well below maximum rating.
- 5 - Conservatively rated for continuous duty.
- 6 - All parts accessible.
- 7 - Modern artistic cabinet styling.
- 8 - Chrome trimmed, accurate, $3\frac{1}{2}$ " meters.
- 9 - Requires minimum floor space.
- 10 - All high voltage circuits interlocked.
- 11 - Custom tested on customer's channel.
- 12 - Each RF stage metered.
- 13 - Can be used in building block arrangement to increase power.

USES

The FM-250A is a conservatively rated 250 Watt FM Transmitter designed to operate between 88 and 108 MC. This transmitter combined with an antenna gain of two can adequately serve a small city.

The FM-250A may also be used as a driver for a 3KW or 5KW amplifier.

DESCRIPTIONElectrical

The FM-250A is a crystal controlled phase modulated transmitter. Its block diagram is presented below. Frequency stability of .001% is assured by utilizing a thermostatically controlled heated crystal. Modulation is obtained by utilizing conventional pulse networks and varying the phase at these pulses at an audio rate.

All of the RF stages, save for the final PA, are frequency multipliers. Thus, only the final 4-250A tube requires neutralization.

Ten Watts of RF drive are available but only a small portion of this drive is required to obtain rated power.

The final 4-250A is operated very conservatively and exceptional tube life should be expected.

All circuits of the FM-250A can be tuned from the front panel. This ease of tuning plus the accessibility of meters for every RF circuit permits ease of operation; maintenance and technical analysis.

Only one switch is required to operate the transmitter but independent controls are available to operate the exciter and PA units independently. Time delay and overload units adequately protect the transmitter. This simplicity in controls permits the use of an inexpensive accessory kit for achieving remote control of the FM-250A.

A test switch is provided which permits the operator to make readjustments to the equipment under low P.A. plate voltage conditions. This feature reduces the possibility of damage during initial tuning up period.

MECHANICAL

The FM-250A is self contained in an attractive custom cabinet. The entire unit is only 68 3/8" high.

It requires only the addition of tubes, crystal, audio input and power input lines to begin operation.

SPECIFICATIONS

Performance Specifications

Type of Emission	-	FM
Frequency Range	-	88 to 108 MC
Rated Power Output	-	250 Watts

RF Output Impedance	-	50 Ohms
Input Impedance	-	600/150 Ohms
Input Audio Level	-	±10 ± or - 2dbm
Amplitude vs Frequency	-	± or - 1db from 50 to 15,000 cycles
Carrier Frequency Stability	-	± or - 1000 cycles
Modulation Capability	-	± or - 100 KC
Audio Frequency Distortion	-	1.5% max. 50 - 100 cycles 1.0% max. 100 - 7500 cycles 1.5% max. 7500-15000 cycles
FM Noise Below ± or - 75KC	-	60db
AM Noise, RMS	-	50db below carrier
Harmonic Attenuation	-	at least 60db (Ratio of any single harmonic to carrier)

Electrical Specifications

Power Line Requirements		
Transmitter	-	115v 50/60 cycles - 1 phase
Slow Line Variation	-	± or - 5%
Rapid	-	± or - 3%
Regulation	-	3%
Power Consumption	-	975 Watts (Approximately)
Power Factor	-	90%

Mechanical Specifications

Transmitter Overall Dimensions		
Width	-	23 1/16"
Height	-	68 3/8"
Depth	-	22 7/8"
Weight	-	500 lbs. (Approximately)
Maximum Altitude	-	7500 feet

Ambient Temperature - 45°C Max.
10°C Min.

TUBE COMPLEMENT

<u>Quantity</u>	<u>Tube Number</u>
4	12AT7
1	12AX7
1	12AU7
6	6BH6
1	57C3
1	6146
1	4-250A
2	866-A
1	5R4GY
2	OD3



INDUSTRIAL TRANSMITTERS AND ANTENNAS
7327-A WEST CHESTER PIKE
UPPER DARBY, PENNA.
FLanders 2-0355

RECEIVED
FEBRUARY 9 1958
NAAB HEADQUARTERS

FEB 8 1958

AA
7 8 9 10 11 12 1 2 3 4 5 6 PM

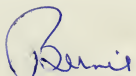
Mr. Cecil S. Bidlack
Television Engineer
National Association of Educational Broadcasters
14 Gregory Hall
Urbana, Illinois

Dear Mr. Bidlack:

Thank you ever so much for including an announcement
of our company's activities in your recent publication.

Attached to this letter are catalog sheets that describe our new 10 watt unit.

Best personal regards,

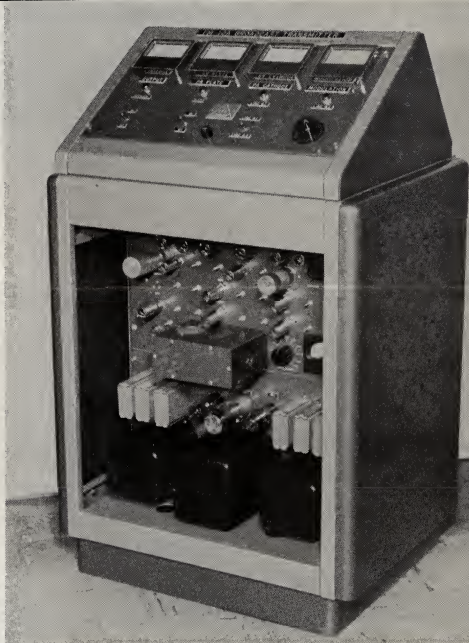

Bernard Wise

BW/jg
Encls.



FEATURES

- Designed primarily for educational installations.
- May be operated unattended.
- May be operated by remote control.
- Provides facilities for audio switching.
- Housed in modern artistic cabinet.
- Meters provided in turret for final plate voltage, cathode current, output power and input modulation level.
- Audio attenuator pad provided on control turret.
- Utilizes high quality standard parts.
- Conservatively rated for continuous duty.
- custom tested on customer's channel.
- Meets all FCC specifications.
- Can be used in building block arrangement to increase power.



USES

The FM-10A is a 10 Watt FM Transmitter designed to operate on any fixed frequency between 88 and 108mc. It can be used as an independent unit for transmitting FM intelligence or as a driver for a medium power FM amplifier. In particular, this unit is ideally suited for low power educational stations, where the coverage of campus and immediate areas are required. Since this transmitter incorporates audio switching and attenuation features, a minimum of studio equipment will be required to form a complete station. Since the FM-10A utilizes identical circuitry to that used in high power commercial transmitters, students can derive technical as well as program experience from its operation.

MECHANICAL - The FM-10A is housed in an attractive custom cabinet and incorporates a modern styled control turret. It requires a floor space of $18\frac{1}{2}'' \times 23\frac{9}{16}''$. The transmitter is completely self contained and requires only the installation of tubes, crystal and the connection of audio and power lines before operation can begin.

DESCRIPTION

ELECTRICAL - The FM-10A is a crystal controlled phase modulated transmitter. Frequency stability of .001% is assured by utilizing thermostatically controlled crystal heaters. The broad audio frequency response is achieved by utilizing conventional pulse shaping and phase modulating circuits. The RF frequency multipliers are driven into saturation, thus reducing AM hum to a negligible value. It should be noted that no RF stage acts as an on frequency amplifier. This eliminates the problem of neutralization and assures freedom from parasitics and continuity of programming. All circuits of the FM-10A can be tuned from the front panel. This ease of tuning plus the availability of meters for every RF circuit permits ease of operation, maintenance and technical analysis. A power output meter on the meter turret gives a direct reading of transmitter output. Facilities for switching two audio inputs are available. Their levels are adjusted by a front panel attenuator to achieve the desired value on the "modulation meter".



Lewis:

Can you give me a list of all outfits that
make FM transmitters?

As you note by the attached this is more
low-price stuff.

I want to hit them all for \$\$\$\$ in the name
of NAEP for a brochure.

70-DH — R. E. L. Federal

417-49 Raytheon Western Electric
Collins Gates

R. C. A.

S. E.

If you want the addresses to Mary
Ellen can make a list from my file. Lewis



January 10, 1949

DO BROADCASTERS WANT FM IN COLLEGES?

Most assuredly! It provides FM without the commercials and builds an audience for your FM station whether on the air now or in the future.

Tell your nearby college, high school or religious group about the new BF-E-10 transmitter for ten watts of high quality broadcasting - in the regular FM band - use any antenna, any height (the higher the better of course) - no monitors are required and hours of operation may be without schedule.

The price of the BF-E-10, which is actually the exciter for all Gates FM transmitters, plus other needed equipment, is \$1750.00 complete. We have an excellent single ring antenna with five foot mast to go with it at \$375.00 - allow \$50.00 for transmission line and what do you have? - For \$2175.00 a complete radio station, antenna and all, ready to attach to studio equipment.

Gates is conducting tests under special FCC authority to determine expected coverage. The results to date are remarkably good - Encourage your schools to go FM and build FM for yourselves. A Gates field engineer will gladly follow up any recommendation you make.

Thank you!

Yours very truly,

GATES RADIO COMPANY

WNYC



WNYC-FM

CITY OF NEW YORK
MUNICIPAL BROADCASTING SYSTEM
MUNICIPAL BUILDING
NEW YORK 7, N. Y.
WORTH 2-5600

FILE NO. SNS:cb

January 13, 1949.

Mr. Dick Hull
Station WOI
Ames, Iowa

Dear Dick:

I have your note of January 1st and as far as I am concerned, the dates of October 23, 24 and 25 will be preferable for a meeting at Michigan. Insofar as the February meeting is concerned, it is virtually impossible for me for me to get out to Chicago or St. Louis in February. I believe I indicated that to you in my last note.

The ideas you mentioned seem to have a great deal of merit. I would like to see more "how to do it" no matter how they are organized.

With best wishes, I am

Cordially yours,

Seymour N. Siegel
Director

*I slapped an application in on Channel 276
just because it was available - I don't know
what will happen!*



January 10, 1949

FM BROADCASTING - UNDER NEW FCC RULES FOR EDUCATION

A recent FCC ruling allows educational institutions to install and operate a ten watt FM transmitter with any height antenna and without complicated or expensive accessories. The schedule may be as you want it - operators may be second-class.

What does this mean to your school? - Radio broadcasting at low cost and without headaches. - Now a radio class with "on the air" training is possible. City, and possibly area-wide coverage is provided for college and school events.

Radio is possible - ready to go - for as little as \$2175.00 with antenna, and ready to attach to your present studio training equipment. If you presently do not have studio equipment the added cost can be small.

Why not ask a Gates field engineer to call and explain how easy radio - on the air - can be added to your college curriculum. Eastern folks may wish to use our Washington office in the Warner Building - Phone Metropolitan 0522 - others may use our Quincy, Illinois, address on this letterhead.

Yours very truly,

GATES RADIO COMPANY


EDUCATIONAL BROADCASTING

WITH THE

GATES BFE-10 TRANSMITTER

**EXPENSIVE TOWERS UNNECESSARY
EASY TO INSTALL**

**OPERATOR LICENSE REQUIREMENTS ARE EASY TO FULFILL
SPACE REQUIREMENTS ARE SMALL**



Front view of the BFE-10 educational broadcast transmitter. The front cover has been removed to show the tube and component arrangement.

Now any educational institution can have a good FM broadcast station quickly by installing the Gates BFE-10 transmitter and a small amount of accessory equipment. The cost is low, it is easy to install and the operating expense is no greater than for a large home radio.

Advantages of Having A Radio Station In Your School

Educators have long acknowledged the psychological advantages of conducting academic pursuits in an atmosphere of practical reality. Now, with the advent of educational broadcasting on the FM band, classes in radio instruction can be carried on using a regular broadcasting station as the major tool in the training. Then, too, a broadcasting station brings the student body and its activities closer to the community, makes full broadcast time available for the school and establishes it as the leader in progress. FM (Frequency Modulation) broadcasting is coffee shop and dinner table talk throughout the country. It is the most modern mode of aural broadcasting. Most sets have the FM band on them and are located not only in high income but also in the majority of middle income homes. With the Gates BFE-10 transmitter station cost is reduced to such a reasonable figure that any budget can easily include it and thereby offer a completely modern course in radio broadcasting technique.

Low power Frequency Modulation Broadcasting has been made possible by the Federal Communications Commission by a recent ruling that permits a station power of 10 watts and eliminates the necessity of using expensive and complicated monitoring equipment. Due to the relatively low power the physical size of the equipment is small, permitting easy handling and adjustments are few and easy to make.

The Gates BFE-10 transmitter fulfills the requirements for the transmitter portion of the regulations. Antenna requirements are easy to meet as there is no minimum height requirement eliminating the necessity of expensive supporting structures. Licensed operators are required but may be of Second Class rating. Hours of operation are optional and need not adhere to any schedule.

Though "educational institution" has not been defined by the Commission, it is assumed that the term includes any organized body engaged in the dissemination of any kind of academic training or education as high schools, colleges, universities, religious and scientific bodies. No commercial operation is allowed.

Technical Information About The BFE-10 Transmitter

The complete transmitter is housed in a steel cabinet 36 inches high, 34 inches wide and 24 inches deep. This small size, although ample for a transmitter of this power, enables placement on a table and keeps space requirements to a minimum. Cabinet finish is in grey enamel which is neutral enough to harmonize with any color scheme, yet is so pleasing in tone that it definitely adds to the appearance of the room in which it is placed.

Meter equipment is complete in the BFE-10. Five 3-inch meters are placed along the top which read

GATES RADIO COMPANY, QUINCY, ILLINOIS

radio frequency line current, power amplifier plate current, power amplifier plate voltage, and power line voltage. In the center is a VU meter so connected that full 75 kilocycle swing modulation is obtained when program peaks come up to the red line. A meter, used to indicate plate current in any of the various stages, is located behind the front panel on the vertical chassis. It is connected into any of the stages by means of a rotary switch adjacent to the meter. Three controls are placed near the bottom of the cabinet for adjustment of power line voltage, turning the power on and off and regulating the power output of the transmitter.

Basically, the BFE-10 transmitter consists of the exciter that is used in all Gates higher powered FM transmitters with the addition of a power supply, meters and controls which make it a finished 10 watt transmitter.

Modulation is accomplished by the phase method which has the advantage of permitting direct crystal control of the oscillator. The oscillator operates at a frequency in the vicinity of 250 kilocycles and this frequency is multiplied many times in successive stages to obtain the final operating frequency. A crystal of low temperature coefficient is supplied in an oven the temperature of which is within limits considerably closer than are required for good operation or the regulations of the Federal Communications Commission. Provision is made for the second crystal and oven, and it may be added at any time. Differences in characteristics of modulator tubes are compensated by a unique feedback circuit to eliminate any necessity of readjustment and thus retain the excellent operating conditions obtained by the original factory tune up.

Maintenance of the BFE-10 transmitter is easy as it is mechanically arranged to be very accessible. Large panels, both in front and rear, are easily removable, which enable examination of the tubes from the front and components from the rear. A dust cover which encloses the back of the modulator and radio frequency chassis is held on by four thumb screws and can be quickly taken off whenever necessary. All power and audio input connections are located on a barrier type terminal strip mounted just inside the rear opening. The radio frequency output line is terminated on top of the transmitter near the left front corner and is designed to couple to RG-8U coaxial cable.

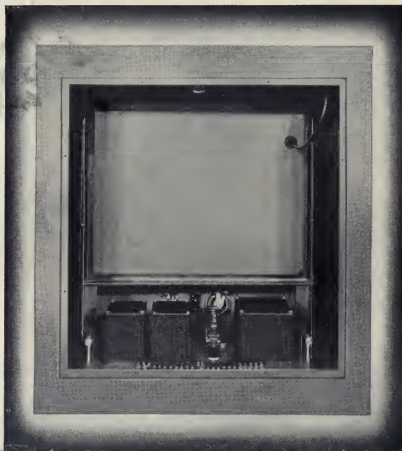
Installation

This is a very simple procedure. The transmitter is pretuned at the factory. Locate the antenna on the tallest available building, connect the coaxial transmission line and, with the assistance of an engineer from the nearest broadcast station, the few adjustments on the transmitter and antenna installation can be quickly made.

SPECIFICATIONS

POWER OUTPUT—10 watts nominal rating.
 FREQUENCY RANGE—88 to 108 megacycles.
 R. F. OUTPUT IMPEDANCE—40-80 ohms.
 TYPE OF OSCILLATOR—Direct crystal control.
 FREQUENCY STABILITY—Plus or minus 500 cycles.
 TYPE OF MODULATION—Phase shift.
 MODULATION CAPABILITY—100 kilocycles.
 AUDIO INPUT IMPEDANCE—600 ohms.
 AUDIO INPUT LEVEL—Approximately plus 10 decibels.
 FREQUENCY RESPONSE—Within 1% Db of standard 75 microsecond pre-emphasis curve.
 DISTORTION—Less than 1% 50-100 cycles, less than 1% above 100 cycles.
 TUBE COMPLIMENT—Two Type 5Z3, Nine Type 6SJ7, One Type 6SN7, One Type 6V6 (metal), One Type 815, One Type 829-B, One Type 5893 G. E.
 POWER INPUT—165 watts, approximately.
 POWER SOURCE—115 volts 60 cycle single phase.
 DIMENSIONS—36 inches high, 34 inches wide, 24 inches deep. Approximately 31 cu. ft. boxed for export shipment.
 WEIGHT—Net approximately 225 lbs.
 Gross packed for export, approximately 300 lbs.

BFE-10 Transmitter—With one set of tubes, one crystal and oven. Code ZARIG.



Rear view of the BFE-10 transmitter shows the power supply in the bottom and the transmitter portion just above. The inside cover over the transmitter chassis is easily taken off by removing the four thumb screws in the corners and disconnecting the coaxial output feed line at the fitting on the top of the transmitter.

Price

If you already have equipment for a broadcast studio, the additional cost for a BFE-10 transmitter, antenna, and the few other accessories probably will be in the vicinity of \$2200.00. If studio equipment is required, \$3000.00 could provide a complete transmitter, antenna and studio installation in most cases. Gates sales engineers can readily work out a plan for you to install the necessary items now, and add others later when a more comprehensive outlay is advisable.

WTC
NAEB Low Power FM

April 21, 1949

Merrill F. Chapin
General Electric Company
12 So. Sixth Street
Minneapolis, 2, Minnesota

Dear Mr. Chapin:

Thanks very much for your April 7th letter and your reminder of the General Electric low power FM equipment. I am answering on this particular letterhead for the reason that many of our members are interested in low power FM, but Iowa State College, itself, has just completed construction on a 15,600 watt FM station which will transmit from a 584-foot tower.

I am enclosing a copy of our current News Letter which goes to the more than 100 member institutions, a good share of whom operate either FM or AM broadcasting stations, and to many other interested sources such as the U. S. Office of Education, the FCC, and to each institution who we hear is contemplating FM broadcasting.

You will notice in the present issue, with respect to low power FM, we have mentioned the Radio Engineering Laboratories' low power SERRASOID transmitter. In previous issues we have given due attention to the G. E. low power transmitter.

My reason for calling this to your attention is the plan of NAEB to enlist the cooperation of the several manufacturers concerned in providing partial financing for an inexpensive bulletin which will tell the low power FM story.

As you may know, at least one manufacturer of this equipment has prepared a brochure which unintentionally contains much misleading information, not as to basic cost, but as to operating cost of such an FM station. Furthermore, much of the publicity we have seen to date is clearly not written with a good knowledge of what goes on in a college president's mind. Admittedly that on occasion these mental processes are somewhat baffling, nonetheless, this same president provides the financing for any such radio project.

Consequently, it has seemed to us that a brief booklet which showed

Merrill F. Chapin

2

April 21, 1949

all costs and the real educational broadcasting and training opportunities inherent in the low power, low cost FM installation would not only serve NAEB, but provide a very real service to the manufacturers concerned.

Yours sincerely,

Richard B. Hull
President

VS
enc.

W A E B - F C C

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington 26, D. C.

24781
FCC 48-1958

In the Matter of

Amendment of Sub-part C
Part 3 of the Commission's
Rules and Regulations

Docket No. 9048

"Low Power FM"
jords nancy

Hull

ORDER

At a session of the Federal Communications Commission held at its offices in Washington, D. C., on the 18th day of August, 1948;

The Commission having under consideration a proposal to amend various sections of Sub-part C of Part 3 of the Commission's Rules and Regulations relating to non-commercial educational FM broadcast stations; and

IT APPEARING, That Notice of Proposed Rule Making setting forth the above amendments was issued by the Commission on June 17, 1948, and was duly published in the Federal Register, which notice provided that interested parties might file statements or briefs with respect to the said amendment on or before July 26, 1948; and

IT FURTHER APPEARING, That the Commission has received two comments supporting the adoption of the proposed amendments in the form presently proposed, and one further comment proposing that the Commission authorize non-profit commercial operation of low-powered non-commercial educational FM broadcast stations;

IT FURTHER APPEARING, That the above proposal is beyond the scope of the Notice of Proposed Rule Making which dealt only with amendments to the rules dealing with engineering and related matters; and

IT FURTHER APPEARING, That the adoption of the said amendment will make possible the entry into the non-commercial educational FM broadcast field of many educational institutions which might not be able to afford the construction and operation of high-powered stations;

IT IS ORDERED, That, effective September 27, 1948, Sub-part C of Part 3 of the Commission's Rules and Regulations IS AMENDED as set forth in the appendix attached hereto.

FEDERAL COMMUNICATIONS COMMISSION

Released: August 19, 1948

T. J. Slowic,
Secretary

A P P E N D I X

Sub-part C of Part 3 of the Rules and Regulations is amended as follows:

- (1) Section 3.503 --- Title of section is amended to read, "Licensing requirements and service."
- (2) Sections 3.504 and 3.505 -- Are amended to read as follows:

§3.504 Frequency, Power and Service Area: (a) In the assignment of frequency and power to a noncommercial educational FM broadcast station the Commission will consider with the application: (1) the area served by applicant's existing educational facilities; and (2) the provisions of any statewide plan on file with the Commission which meets the requirements of Section 3.502. A station licensed for transmitter power output of 10 watts or less normally will be licensed to operate on the frequency 88.1 megacycles, however, should it appear that operation on this frequency would cause objectionable interference, such station may be licensed to operate on the next higher frequency that would not cause objectionable interference.

(b) The license of each noncommercial educational FM broadcast station licensed for transmitter power output of 10 watts or less shall specify the maximum authorized operating power output of the transmitter. The license of each noncommercial educational FM broadcast station licensed for transmitter power output above 10 watts shall specify the authorized effective radiated power of the station and the authorized operating power output of the transmitter.

(c) Each application for a new noncommercial educational FM broadcast station or increase in facilities of an existing station which proposes transmitter power output above 10 watts shall contain a determination of the antenna height above average terrain and the extent of the 1 mv/m and 50 uv/m contours of the proposed station by the methods prescribed in the Standards of Good Engineering Practice concerning FM broadcast stations.

§3.505 Standards of Good Engineering Practice: The definitions and interference standards contained in the Standards of Good Engineering Practice Concerning FM Broadcast Stations shall be applicable to noncommercial educational FM broadcast stations. Other portions of such Standards shall be applicable to the extent specifically prescribed by those rules.

- (3) Section 3.515 --- Is amended so that a new subsection (c) is added to read as follows:

(c) If a construction permit has been allowed to expire for any reason, application may be made for a new permit on FCC Form 321 "Application for a Construction Permit to Replace Expired Permit".

- (4) Sections 3.551, 3.552, 3.553 and 3.554 --- Are amended to read as follows:

§3.551 Transmitter power --- (a) The standard power rating of the transmitter of a noncommercial educational FM broadcast station licensed for transmitter power output above 10 watts shall be in accordance with the Standards of Good Engineering Practice Concerning FM Broadcast Stations.

(b) The standard power rating of the transmitter of a non-commercial educational FM broadcast station licensed for transmitter power output of 10 watts or less shall be not less than the authorized operating power and not more than 10 watts.

§3.552 Frequency Monitor. - (a) The licensee of each non-commercial educational FM broadcast station licensed for transmitter power output above 10 watts shall have in operation at the transmitter a frequency monitor independent of the frequency control of the transmitter. The frequency monitor shall be approved by the Commission. (See Approved Frequency Monitors and Requirements for Type Approval of Frequency Monitors in the Standards of Good Engineering Practice concerning FM broadcast stations.)

(b) The licensee of each noncommercial educational FM broadcast station licensed for transmitter power output of 10 watts or less shall provide for the measurement of the station frequency by a means independent of the frequency control of the transmitter. The station frequency shall be measured (1) when the transmitter is initially installed, (2) at any time the frequency determining elements are changed, and (3) at any time the licensee may have reason to believe the frequency has shifted beyond the tolerance specified by the Commission's Rules.

§3.553 Modulation Monitor. - (a) The licensee of each non-commercial educational FM broadcast station licensed for transmitter power output above 10 watts shall have in operation at the transmitter a modulation monitor approved by the Commission. (See Approved Modulation Monitor and Requirements for Type Approval of Modulation Monitors in the Standards of Good Engineering Practice concerning FM Broadcast Stations.)

(b) The licensee of each noncommercial educational FM broadcast station licensed for transmitter power output of 10 watts or less shall provide at the transmitter a percentage modulation indicator or a calibrated program level meter from which a satisfactory indication of the percentage of modulation can be determined.

§3.554 Transmitter performance. - (a) The transmitter proper and associated transmitting equipment of each noncommercial educational FM broadcast station licensed for transmitter power output above 10 watts shall be designed, constructed, and operated in accordance with the Standards of Good Engineering Practice Concerning FM Broadcast Stations.

(b) The transmitter proper and associated transmitting equipment of each noncommercial educational FM broadcast station licensed for transmitter power output of 10 watts or less, although not required to meet all requirements of the Standards of Good Engineering Practice Concerning FM Broadcast Stations, shall be constructed with safety features in accordance with the specifications of Article 810 of the current National Electrical Code as approved by the American Standards Association and shall be so operated, tuned, and adjusted that emissions are not radiated outside the authorized band which cause or which are capable of causing interference to the communications of other stations. The audio distortion, audio frequency range, carrier hum, noise level, and other essential phases of the operation which control the external effects, shall at all times be capable of providing satisfactory broadcast service. Studio equipment properly covered by an underwriter's certificate will be considered as satisfying safety requirements.

(5) Section 3.556(c) ---- Is amended to read as follows:

"(c) Both transmitters shall meet the requirements of Section 3.554."

(6) Section 3.557(a)(2) ---- Is amended to read as follows:

"(2) That would result in the external performance of the transmitter being in disagreement with Section 3.554."

(7) Section 3.557(d) ---- Is amended to read as follows:

"(a) Other changes, except as above provided for in this section, may be made at any time without the authority of the Commission, provided that the Commission shall be promptly notified thereof and such changes shall be shown in the next application for renewal of license."

(8) Sections 3.567 and 3.569. -- Are amended to read as follows:

§3.567 Operating power; determination and maintenance of. -

(a) The operating power of each station licensed for transmitter power output of 10 watts or less shall be determined by the methods proscribed in the Standards of Good Engineering Practice Concerning FM Broadcast Stations. The power at which the station is operated may be less than the licensed power but shall in no event be more than 5 percent above the licensed power. The transmitter of each such station shall be so maintained as to be capable of operation at maximum licensed power.

(b) The operating power, and the requirements for maintenance thereof, of each station licensed for transmitter power output above 10 watts shall be determined by the methods proscribed in the Standards of Good Engineering Practice Concerning FM Broadcast Stations.

§3.569 Frequency tolerance. - (a) The center frequency of each noncommercial educational FM broadcast station licensed for transmitter power output of 10 watts or less shall be maintained within 3,000 cycles of the assigned center frequency.

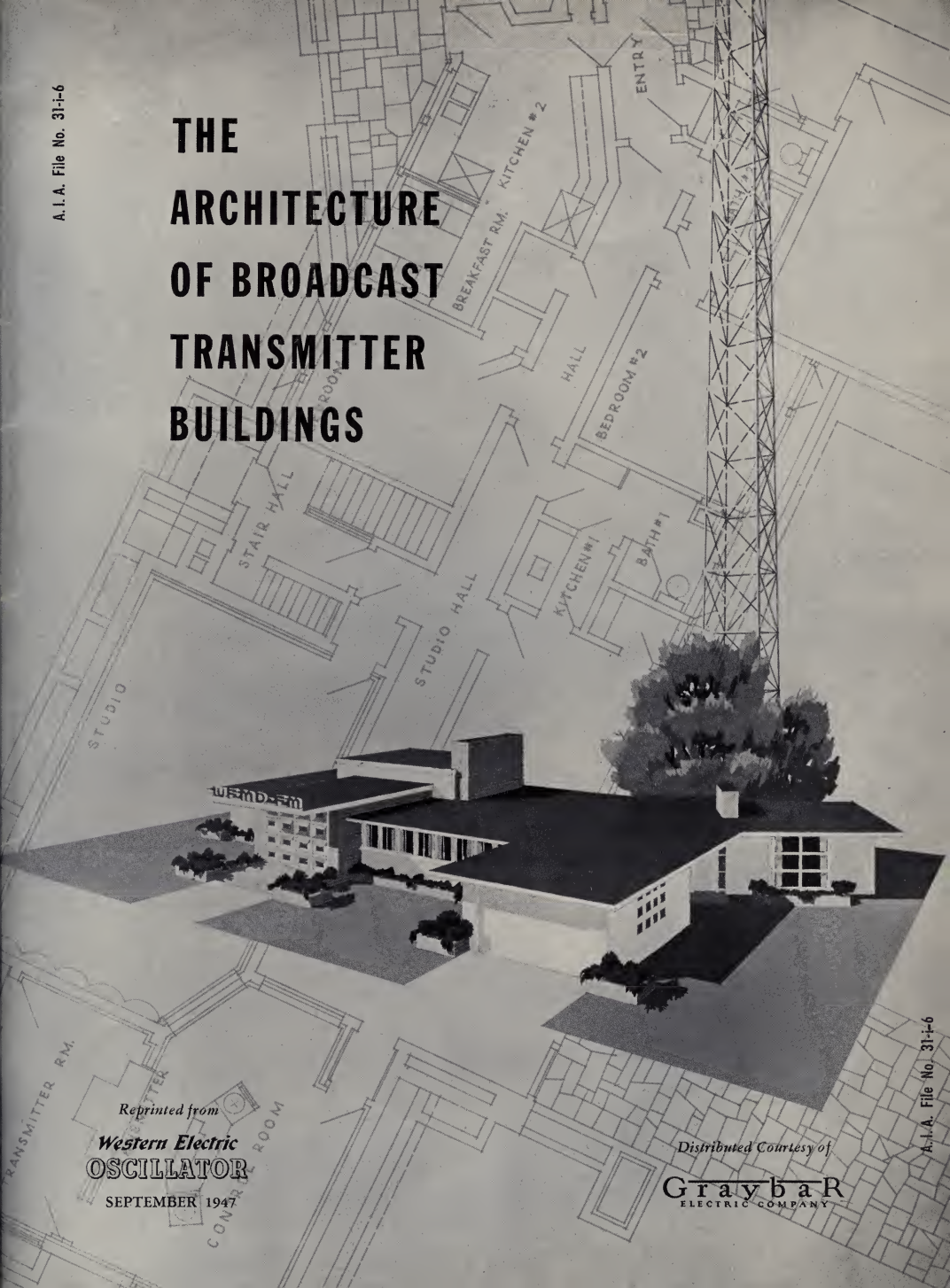
(b) The center frequency of each noncommercial educational FM broadcast station licensed for transmitter power output above 10 watts shall be maintained within 2,000 cycles of the assigned center frequency.

(9) Section 3.581(b)(4) --- Is amended to read as follows:

(4) For each station licensed for transmitter power output above 10 watts, an entry of the following each 30 minutes:

- (i) Operating constants of last radio stage (total plate current and plate voltage).
- (ii) Radio frequency transmission line meter reading.
- (iii) Frequency monitor reading.

THE ARCHITECTURE OF BROADCAST TRANSMITTER BUILDINGS



Reprinted from
**Western Electric
OSCILLATOR**

SEPTEMBER 1947

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Graybar
ELECTRIC COMPANY

THE ARCHITECTURE OF BROADCAST TRANSMITTER BUILDINGS

PLANNING

DESIGN

CONSTRUCTION

TECHNICAL REQUIREMENTS





You are facing a serious problem — the construction of a home for your new broadcast transmitter, a transmitter building that will be an efficient part of the technical operation of your broadcasting business.

This guide has been prepared to help you and your builder over this hurdle, by assembling in compact form as much information as possible on the basic principles that underlie the design of practical, efficient transmitter buildings.

It is presented for use by the broadcasting industry, but especially for the newcomer, whatever the make, type, or power rating of his transmitter, who must put a house around it before he can close ranks with the rest on the air.

SECTION I

Building the Home for Your Broadcast Transmitter.

Pages 6 to 22. Step-by-step discussion of site selection, layout of the building, construction methods.

SECTION II

Transmitter Buildings with a Future. Pages 23 to 35.

Six original designs for modern transmitter buildings, prepared especially for this guide by Deigert and Yerkes, Communications Architects, Washington, D. C.

SECTION III

A Survey Study of 610 Broadcast Transmitter Buildings. Pages 36 to 39. A detailed picture of the American transmitter building, based on replies to a questionnaire distributed to the broadcast industry.

SECTION IV

Six Outstanding Buildings of Today. Pages 40 to 51.

Six buildings of exceptional quality, in use by broadcast stations from 250 watts to 50 kilowatts, with floor plans, and interior and exterior photographs.

SECTION V

The Face of the American Transmitter Building.

Pages 52 to 55. The exteriors of twenty-four attractive buildings of varied style, location and size.



S. P. Taylor

Manager, Distributor Sales
Radio Division
Western Electric Company

A COOPERATIVE ENTERPRISE FOR BROADCASTING

DOMINATING the multitude of questions which constantly come to us has been the one regarding transmitter building design. This has been particularly so during the rapid expansion of the Radio Broadcasting Industry over the past two years. Consistent with our established policy of cooperating with the Industry and in the hope of contributing an answer to this question, the *Oscillator* launched a series of surveys and studies on transmitter building design and construction. The results, offered in the pages which follow, represent the combined knowledge and experience of many authorities.

In this project we find demonstrated once more the spirit of cooperation which we believe to be one of the most important factors in bringing the Radio Broadcasting Industry to its present level of achievement and technical excellence. Indeed, its pooling of knowledge, skills and experiences from within and from without is one of the most striking elements of the Industry's development. In my capacity as Manager, Distributor Sales of Western Electric's Radio Division and as Chairman of the Transmitter Division of the Radio Manufacturers Association I have witnessed this spirit in operation many times.

In preparing this guide, we had the advantage in full measure of this same spirit of cooperation. In this instance I saw how freely and willingly hundreds of busy chief engineers and hard-working station managers from stations all over the land answered questionnaires, sent in blueprints, designs and valuable suggestions and how some of the country's foremost network engineering executives and leading architects in the radio field gave of their time and experience to insure the project's success.

So this guide, compiled from all of these sources, is presented for the benefit of all broadcasters. Use it as you wish. We hope it will in this way be fully justified by its value to you and to the whole Industry.

THEY MADE THIS GUIDE POSSIBLE
 Recognized throughout the industry as engineering and architectural authorities, these seven men, acting as consultants, gave unstintingly of their time, knowledge and experience in the planning and preparation of this guide.

ADOLPH BERNARD CHAMBERLAIN, Chief Engineer, Columbia Broadcasting System. A pioneer in network engineering and in the design, installation, operation and maintenance of many phases of broadcast equipment, he was responsible for the planning and construction of the engineering facilities of such an outstanding array of stations as KNX, Hollywood, Calif.; WTOP, Washington, D. C.; WCBS, New York, N. Y. and WEEI, Boston, Mass.

ROYAL V. HOWARD, Director of Engineering, National Association of Broadcasters; for 14 years vice president in charge of engineering for The Associated Broadcasters, Inc., and subsidiary companies of San Francisco, holds a number of patents on radio equipment. He is a Senior Member of the IRE and a member of the AIEE. He is Technical Advisor to the United States Delegation at the International Telecommunications (Radio) Conference.



ADOLPH BERNARD CHAMBERLAIN



ROYAL V. HOWARD

JAMES L. MIDDLEBROOKS, Facilities Engineer for the American Broadcasting Company, a former Director of Engineering of the NAB, has to his credit the engineering design and erection of many well known stations, including KSFO, San Francisco; WJJD, Chicago; WKRC, Cincinnati; WSAI, Cincinnati and KOIN, Portland, Ore. Formerly a member of Columbia Broadcasting System's Engineering Department, he also served as Technical Director of the Broadcast Division of Field Enterprises, Inc.



JAMES L. MIDDLEBROOKS

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DAVID NORTON YERKES, architect, member of Deigert & Yerkes, Communications Architects, BFA, Yale University, member of the American Institute of Architects and an Associate of the Acoustical Society of America. Among the stations now being designed by the firm of Deigert & Yerkes are WFMD-FM, Frederick, Md.; WDNC, Durham, N. C.; WINX, Washington, D. C.; WASH, Washington, D. C.; WRUN, Utica, N. Y. and WRUN-FM, Rome, N. Y.; WMCP-FM, Baltimore; KVUN, Los Angeles; KUBR, St. Louis, Mo. and WVUN, Chattanooga, Tenn.

J. R. POPPELE, Vice President and Chief Engineer of WOR, heads a staff of 80 technical experts. A pioneer in broadcasting, he early instituted and supervised at WOR a fine engineering laboratory. He was an early experimenter in FM and Television. He is President of the Television Broadcasters Association, Senior Member of the IRE, a director of the Veteran Wireless Operators Association. He belongs to the Radio Club of America, the Acoustical Society and the Society of Motion Picture Engineers.



J. R. POPPELE

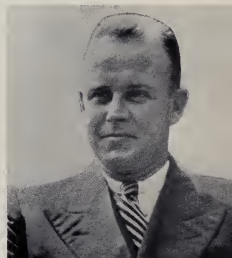
JOHN W. RAGSDALE, Associate Editor, *Architectural Record*, a graduate of Princeton University, 1937. He was News Editor of the Record from 1939 to 1941. As Associate Editor, he has been engaged for the Record in the preparation of a monthly series of Building Types Studies, involving analysis and description of latest trends in the planning, design and construction of such architectural types as apartments, churches, factories, hotels, hospitals, libraries and stores.



ROBERT CAMPBELL DEIGERT



DAVID NORTON YERKES



JOHN W. RAGSDALE

SECTION I

Building the Home for Your Broadcast Transmitter

By R. S. Lanier

Whatever kind of building you put up to house your broadcast transmitter, you are going to live with it constantly, day in and day out, for a long time to come. If it fails, even in small ways, to give the transmitter the proper conditions for trouble-free, efficient operation, or if it throws needless obstacles in the way of maintenance and servicing, the cost to you in time, money, and peace of mind will continue to grow as long as you use the building.

The information in the following pages has been brought together to help you in planning a building that will not cause such needless expense, a building that in every respect will be a "home" for your transmitter. The material has been arranged

in outline form, with the following main sections:

A. Preliminary Planning	Page 6
B. Choosing A Site	Page 7
C. Layout of the Building	Pages 9 to 20
D. Technical Accessories	Page 20
E. Building Services	Page 21
F. The Style of Your Building	Page 22

On page 19, you will find a table of "do's" and "don'ts" to give you a quick reminder of various points covered in the article. The table on page 10 constitutes a breakdown of the building units or rooms that go into a transmitter building, so that initial layout can be based on the choice of the units that will be needed in your building.

A. PRELIMINARY PLANNING

1. First, secure expert help in planning and construction

Each management will face a different problem in choosing technical guidance. The available sources upon which you may draw are:

The manufacturer of the transmitter, for full installation details, technical requirements of the transmitter, and assistance in installing and testing;

Your chief engineer and his staff, for adaptation of the technical facilities to your own needs and plans;

The architect, for planning the building itself in accordance with your needs and resources, for coordinating the technical requirements with the various building and contracting services, and for supervising actual construction;

The radio consulting engineer, for advisory services which include preparation of the FCC reports and applications, technical advice on all the special problems of installation and "proof of perform-

ance," or even taking over the complete job of planning your transmitter installation and supervising the whole job until you are in operation;

The building contractor and various subcontractors, who are responsible for the actual erection of your building.

2. These specialists must work together from the beginning

Nothing is more important than for your chief engineer, and your architect or builder, to sit down with a transmitter specialist or with your radio consultant, and, with a *complete* set of installation drawings for the transmitter, to plan all the technical features of the installation.

Architects Deigert and Yerkes emphasize the need for this kind of cooperation: "The design of a transmitter building is a complex problem, involving the close coordination of structural, mechanical, and electrical elements. The designer of the transmitter building is engaged in arranging the various

rooms and equipment to produce a good, workable building. In order to do this he must have a thorough understanding of the functions and the inter-relationship of the equipment as well as of the elements of the building. The engineer is interested in the technical requirements and auxiliary services for the transmitter. The two *must* work together closely to fit the plumbing, heating, structural, and electrical features into a unified whole with the transmitter services, or they will not produce a plant that really works."

3. Expert planning will save you money

Good, workable buildings that provide your transmitter with all of the services it needs are *not* neces-

sarily expensive, but they are necessarily well planned from the beginning. With additional money you can buy additional services and conveniences, but a basically excellent building need cost no more, and indeed often costs less, than a badly designed, poorly constructed, expensive-to-operate building.

Good planning saves money in several positive ways: by preventing mistakes that are costly to rectify; by making efficient use of building materials in a sensible, well-engineered building structure; by arranging the building so that it is easy to maintain and operate. "In the past many transmitter buildings suffered from lack of advance planning," says J. R. Poppele. "The industry is now well aware of the importance of careful layout and design."

B. CHOOSING A SITE

1. Basic formula for site selection is signal strength and coverage versus cost of land, construction and operation

Adequate coverage is the first necessity for the success of any broadcast station. With two or more sites to choose from, you can balance improved coverage against the factors listed below.

2. Factors in site selection

Zoning Restrictions: Visit your municipal or county government early in your negotiations to find what building restrictions, if any, apply to the site.

Roadways: Will you need additional roadways? How much will they cost?

Water: Is fresh water available? Must you sink a well to unknown depths in search of water, with possibly very high costs?

Sewage: What provision must be made for sewage disposal?

Power: Will primary power be easy or difficult to bring in? What about an alternate source of primary power?

Program Circuits: What is necessary to bring in program circuits?

Drainage: Unless your building is specifically adapted to a marshy site, does the land drain properly with the heaviest precipitation to be expected?

Soil and Foundation Conditions: Are there any unusual conditions that will make construction diffi-

cult and costly? Will soil give the ground screen reasonable efficiency?

Transmission Line: Are there any problems in the proposed transmission line run, such as steep grades or soft ground?

Towers: Is there a convenient location for the erection of your antenna towers? Check the Civil Aeronautics Authority for any restrictions on antenna height at the site you are considering.

Accessibility: Will the site have unusual construction and operation costs because of inaccessibility?

3. How much land does a broadcast station need?

FM stations will fit on a small tract of land because they do not require acreage for an antenna ground system. Little more than the building plot, with parking area and appropriate landscaping, will accommodate the majority of FM stations, provided the antenna tower can be erected on or near the building. However, bear in mind the desirability of exercising control over property in the immediate vicinity of the tower in order to avoid the possibility of future erection of a tall structure which might adversely affect the propagation of your FM signal.

AM stations must have land for the antenna ground-
ing area: 1 to 5 acres for non-directional antennas, forty or fifty acres for directional arrays involving two or more towers. If you are putting up an AM

station consider seriously getting a tract large enough for an array even though your single radiator may require only a part of the total. As A. B. Chamberlain puts it: "The only way for many AM stations to increase service area in the future will be through the use of directional arrays. There may come a day when you desperately need those extra acres for a directional antenna system."

4. Marshy or over-water sites give increased radiation efficiency for AM stations, but generally make the building more expensive

The improved propagation characteristics of an AM installation on marshy ground or over water are attractive, but you should have competent estimates of the cost of construction in hand before you can be sure that such a site will "pay off." Building on

marshy ground often involves very expensive underpinning. Building over water will also require special construction methods.

The ideal site from this point of view is one on which the transmitter building can be put up on a waterfront plot by conventional methods, with a short transmission run to the tower system in an adjoining sheltered body of water. The photograph below of Station KRE, Berkeley, California, shows an unusually fine site of this kind.

5. The mid-city building as a transmitter site

The excellent coverage and operating convenience of FM installations in tall city buildings must be weighed against the following:

Are there any zoning restrictions or building or-

Aerial view of 250 watt AM Station KRE, Berkeley, California, with combined transmitter-studio building, shows a site with many advantages. Transmitter is on edge of community, with easy access by main highway. Sheltered body of water provides excellent grounding conditions.



dinances against installation of the transmitter in the building, or the antenna on top of it?

Will the building support the antenna? Will the transmitter overload the floor at the chosen location? A preliminary study by competent engineers on these points is good insurance against unforeseen expense. Structural alterations on modern skyscrapers can be very expensive.

Can you get the transmission line to the roof without interference with other tenants? A top-floor installation makes this easy but is not always available.

Is the power cabling to the transmitter location large enough? Will there be large variations in the power consumed by other tenants, causing irregular supply voltage? A separate power run to the top floor of a tall building is an expensive item.

What about building services such as heat and elevators during your after-midnight operation?

6. Transmitters on mountain tops

As everyone knows, FM and television are "going to the mountains" for antenna height. Obviously a

mountain top is in general a very inaccessible site. Its usual advantage, besides coverage, is *low land cost*. Here are the items that offset this:

Water, roadways, power, program lines are often difficult and expensive to bring in.

The building will cost more, because of the distance both labor and materials must travel.

Severe weather conditions may require special weatherproofing. A study should be made of the maximum wind velocities and rainfall at the proposed site, to be sure that the building will be watertight, especially around doors and windows.

Cost of operation will be higher because of the inaccessibility. Complete living facilities for personnel will be necessary, particularly in areas where "snowing in" can be expected.

The ideal high-frequency site would be a mountain top in or near a city, with consequent short roadways, water, power and signal runs. Station KPFM, which is shown on pages 44 and 45, has an excellent site in this respect with its mountain overlooking the city of Portland, Oregon.

C. LAYOUT OF THE BUILDING

1. Is it better to combine or separate studios and transmitter?

This architectural guide does not discuss studio installations as such. The combination of transmitter and studios will effect certain economies in the cost of building and operation. However, if studios near the business center are desired, separation is often necessary with larger AM transmitters, which must usually go to the country for land of reasonable cost. Mountain-top FM and television transmitters must also usually be separated from the studios.

The different situations are as follows:

Combined studio and transmitter installations are advisable for FM and television stations in tall city buildings, or AM stations in smaller cities where the cost of land for the radiation system is not prohibitive. Many new stations, particularly of low and medium power, have found that a combined installation in a suburban district is practical and economical.

Separate locations for studio and transmitter are

usually necessary with mountain-top sites for FM and television, and AM stations finding "breathing room" for their antenna systems by going into the country.

2. Should a transmitter building be a "show-place" — or just an enclosure for transmitter and operators?

If you have looked over the field to see what kind of building to put up, you are probably in a muddle about these two opposing conceptions.

If your building will be in a remote location, seldom seen by any persons except the operating force, it is obvious that no extra money should be spent merely to give it public appeal. Careful planning and sound architecture, however, *do* pay off heavily, even in remote locations. The difficulties of the site make it even more important and prudent to think carefully in advance, to coordinate the planning of persons involved in the building, and to put up a permanently satisfactory building that will be easy to maintain, with all the facilities necessary for efficiency of the operating force.

Functional Units of a Broadcast Transmitter Building

Essential	Transmitter Room Control Room or Area Washroom Storage Space Work Shop
Desirable	Office Shower Room Kitchen or Kitchenette Emergency Studio Garage
Optional, Depending on Requirements	Living Quarters Employees' Lounge Heater Room Transformer and Power Distribu- tion Room Viewing Lobby or Visitors' Lounge

On the other hand, if your transmitter building is seen regularly by a large number of people in your community, the building becomes a permanent advertisement for your station, establishing in the minds of your listeners the character of your organization. The minimum response to this situation should be a building with a clean, well-balanced exterior appearance, well-kept approaches, architecture neither pretentious nor dowdy. This kind of clean, smart looking building need not cost substantially more than a cluttered, ugly, ramshackle type of building—again it is expert planning that counts.

Each management must make a decision, based on its resources and the probable benefits in good-

will be obtained, as to just how far it wants to go beyond this minimum toward a more elaborate use of the transmitter building in the public relations scheme of the station. Many arrangements are possible, ranging from the use of a glass wall on the control area, a fairly inexpensive and often most effective way of "showing the works" to the public, up to fountained gardens, beautifully furnished visitors' lounges, raised viewing lobbies that circle the whole transmitter area. A number of practical schemes for the accommodation of visitors are shown in the plans in Sections II and IV.

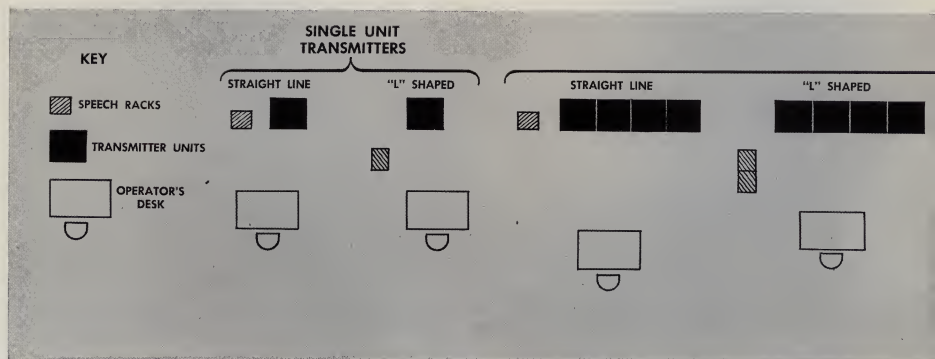
3. Units of the building

Architecturally speaking, a transmitter building can be divided into the unit functions and features shown in the table at the left.

Your planning of interior layout can be based on the selection of the building units or rooms to take care of your particular needs and problems.

The transmitter room and control room are the heart of any transmitter building, and they should be designed first, to accommodate your transmitter and to provide for installation of the services necessary for operation and maintenance. Choice of the other building units or rooms required for your installation can then be made. These additional rooms should be added around the transmitter and control rooms to provide proper and efficient operating flow to the various parts of the building. The transmitter room and control room are discussed in detail be-

BASIC PLANS FOR



low, after which the other building units are taken up in the order shown in the table at the left.

Transmitter Room: The floor space must be sufficient for the transmitter itself, and in addition must provide room completely around it for easy servicing. This means that in back of the transmitter, there must be room to open any swinging doors, *plus* additional room to allow the operator, with portable test equipment or small power tools, to pass the opened doors. The front of the transmitter will face into the control room or area. Detailed characteristics of the control room are discussed beginning on page 14.

The larger transmitters which include auxiliary high voltage or cooling apparatus in separate units will ordinarily have recommended transmitter room layout plans supplied by the manufacturer. Layout of a transmitter room with a number of auxiliary units is based on: (1) short interunit connections; (2) separation of equipment that must be attended in operation, from dangerous high voltage equipment; (3) provision of proper insulation and separation for high voltage wiring runs.

The enclosure of high voltage equipment in separate rooms with "interlock" switches on all entry doors which cut off the power automatically when the door is opened should be planned in accordance with FCC and Underwriters' regulations. These should be studied to make sure that any planned layout of high voltage equipment is in order.

The ceiling height in the transmitter room must include a margin of several feet over the standing

height of the transmitter itself. A minimum over-all ceiling height of 10 feet for AM and 12 feet for FM transmitters is advisable. This is to allow for:

- (1) Access space for servicing meters and other equipment near the top of the transmitter.
- (2) Room for discharge of heat from the tops of small and medium size transmitters.
- (3) For FM transmitters, room for transmission line and harmonic shunt line stubs installed on or near the top of the transmitter. If harmonic shunts are contemplated, careful consideration should be given to the maximum length of stub that would be required, and vertical space allowed accordingly.

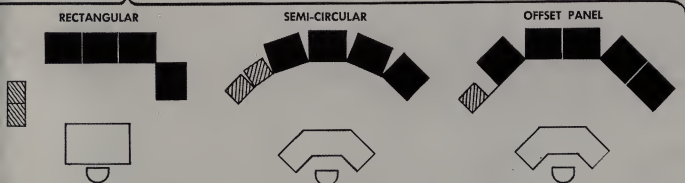
After scaling the room and preliminary placing of the main transmitter units on paper, study the plan from the point of view of the operator. Can he reach control points quickly and easily? Is there room for all normal maintenance, testing and service? Obvious, but sometimes overlooked: Are the doors to the transmitter room large enough for the largest unit of apparatus to be installed? (For placement of the transmitter units with respect to the control desk, see the following section on "control room.")

In the layout of the transmitter room, as in every feature of a transmitter building, *the anticipation of probable expansion* is one of the surest forms of long-range economy. All of the experts agree that every person going into the broadcast business should take a hard look ahead at his future and lay definite plans in the transmitter building for the

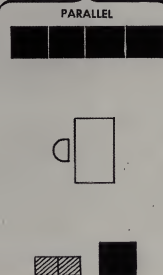
(Continued on page 14)

ARRANGEMENT OF EQUIPMENT

MULTIPLE UNIT TRANSMITTERS
(Including Phasing and/or Standby Equipment)



TWO TRANSMITTERS
(AM and FM or Main and Standby)



TYPES OF BROADCAST

GENERAL ARCHITECTURAL TYPES



WLBC, Muncie, Indiana

CONTEMPORARY: Exterior form in this case evolves naturally from efficient spatial organization of the inside. Showing expert use of modern materials and methods, this building is in harmony with its site and is altogether distinctive in expressing its function.



WRVA, Richmond, Va.

TRADITIONAL: Special conditions may indicate a recourse to tradition. However, symmetries achieved on the exterior may be independent of internal needs. Distinctive expression of the building's purpose here comes principally from the proximity of the antenna.

TYPES ACCORDING TO LOCATION



KDYL, Salt Lake City, Utah

RURAL: Such locations impose fewer limitations to the development of expressive exterior forms. Freedom, however, must not be pushed to the point of defying all environmental restraint, and there should be no attempt to dwarf the out-of-doors with monumentality.



KJBS-FM, San Francisco, Calif.

CITY: The chief prerequisite here is removal above surroundings disturbing to transmission. Thus, ready-made locations make interior planning largely an adjustment to existing spaces and exterior expression limited to the antenna and perhaps some identificatory lighting.

SIMPLE UTILITY TYPES



WHAV, Haverhill, Mass.

CEMENT OR CINDER BLOCK: This example of cement block coated with stucco shows strictly utilitarian use made of economic building materials. In some cases, the locations and surroundings do not really warrant an elaborate concentration on external appearances.



KOAD, Omaha, Nebr.

WOOD FRAME: Many small new stations springing up make few early gestures of special housing. Here a farmer milkhouse has been taken over and converted, with a few swift adaptations inside to take care of equipment and provide rudimentary comforts for personnel.

TRANSMITTER BUILDINGS



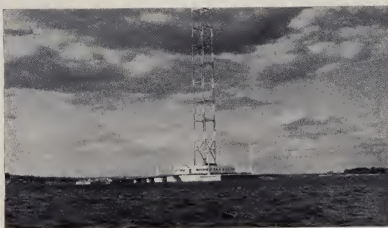
KOB, Albuquerque, N. M.

REGIONAL: This example of a regional type in the Southwest is in harmony with its surroundings, though not to the point of excluding the possibility of other forms being equally successful. This particular type happens to be quite in keeping with interior efficiency and economy and shows how to use style to advantage.



WMIT, Winston-Salem, N. C.

MOUNTAIN TOP: This ideal location for an FM transmitter building does constrain the architect in his choice and handling of materials to provide appropriate shelter. Traditional and regional factors are seldom important, but expressiveness of form must be subordinate to considerations of weather and exposure.



WCBS, New York, N. Y.

ISLAND: A site like this provides as nearly perfect ground conditions as are possible for a permanent transmitter building. The architecture, though functional in appearance to the point of severity, is generally suitable to the purpose and environment. A more elaborate style would probably appear specious.



WWDC, Washington, D. C.

QUONSET: Slightly more creative is this adoption of a familiar structure of general utility to the specific purposes of radio transmission. Although the Quonset form has architectural validity in many functional applications, it is doubtful that it provides the best basis for efficient permanent solutions.



WKYW, Louisville, Ky.

SPECIAL PROBLEM: This solution, in the tradition of the original flood, insures protection against the worst rampages of the Ohio River. Combined height of the concrete piers and former Army pontoon borges put prefabricated transmitter building well above overage high-water mark. Barges are moored fore and aft.

By John W. Ragsdale

Associate Editor, Architectural Record

The exteriors of transmitter buildings should be judged architecturally by the same standards used for other types of buildings. Does the exterior form proceed logically from the planning of interior space and suitably express the building's purpose? Is it harmonious with respect to site and environment? Since a transmitter building's purpose is so essentially of the present, exterior forms in the modern or contemporary manner would seem to be generally appropriate. "Modern," however, does not mean those clichés and rootless stylisms necessitating the term "modernistic." Moreover, there are many cases where exterior expressions in regional, traditional or other manners are amply justified.

(Continued from page 11)

changes he hopes to make. As stated by Royal V. Howard, "Every small or medium power transmitter building should allow for expansion to higher power, if the owners have any hope for normal expansion and growth of their business." In the transmitter room, this means sufficient space for a larger transmitter, and any secondary units required. Such additional floor space costs very little per square foot. A wall of glass brick, unit partitions, or other easily removable construction is one of the simplest and most popular methods of facilitating future expansion in the transmitter room.

After layout of the room, the next major planning job for the transmitter room is that of supplying dirt-free air to the transmitter and auxiliaries and keeping ambient temperature at the proper levels.

Dirt Removal. As pointed out by A. B. Chamberlain, "It is more economical as well as more satisfactory, for maintenance and continuity of service, to supply dirt-free air to the transmitter than to have operating personnel constantly engaged in removing dust and dirt which may eventually cause equipment failures. Filtered air will be found, over the long run, one of the best investments the designer of a transmitter building can make."

An analysis of the normal dirt content of the air

at the transmitter location will give an indication of the problem you face in cleaning up the air for your transmitter room. Simple filters on the air intake of the transmitter cabinet will often be sufficient, particularly if a slight positive air pressure is maintained inside the cabinet. On the other hand, it may be desirable to filter the air for the whole room or building. If the transmitter is not in a separate room, precaution may be necessary against entry of dirt when outer building doors are opened.

With the larger air-cooled transmitters, which pull cooling air from outside the building, close control of dirt becomes of paramount importance. Various types of filters, or an electrostatic precipitator, can be installed in the intake side of an air cooling system. With proper maintenance and operation, the precipitator or other type of filter will provide clean air for cooling the transmitter.

Ambient Temperature. The disposal of waste heat in a broadcast transmitter, to keep the temperatures at safe operating levels, is of course one of the principal design factors for which the manufacturer has made provision. The planner of the building must consider, in addition, the comfort of operating personnel. Thus the general considerations that affect the planning of the transmitter room are as follows:

- (1) In a building cooled by mechanical refrigeration, waste heat should not be added to the load on the cooling equipment, but discharged outside. The waste heat will almost certainly overload the cooling equipment.

- (2) The same will be true if the cooling air for the transmitter is taken from a building area cooled mechanically.

- (3) Thus treatment of transmitter heat separately from that in the building itself is highly desirable, especially in warm climates and whenever mechanical refrigeration is used to cool the building.

- (4) By enclosing the area in back of the transmitter front panel as a separate room, dirt, ventilation and heat disposal can all be handled on the most efficient basis, with the operator's comfort assured.

Control Room: The space in front of the transmitter, or the separate room into which the transmitter faces, must be used as the control room. The central feature of the control room is the control desk, so placed that the operator on duty can monitor the transmitter efficiently during operation.

The layout of the transmitter and the racks of



Beautifully finished control room at WHEC, Rochester, N. Y., has the "L" arrangement of units, with ample space left around control desk.

audio and test equipment around the control desk so that they are easily seen, with ample space for movement of personnel, *is one of the most important planning jobs in any transmitter building.* The sketches at the bottom of pages 10 and 11 have been prepared to show the various basic plans which accommodate themselves well to these requirements, as adapted to single unit transmitters, multiple unit transmitters, and two transmitters. The following principles should guide the layout of the control room or area:

(1) The operator must be able to see the indications of the most essential meters (although not necessarily to read the meters accurately) without leaving the control desk.

(2) The *minimum* distance between desk and transmitter should allow for easy passage of the operator between the two with the transmitter doors open—approximately five or six feet.

(3) As units are added to the transmitter, the control desk must be moved back from the transmitter front, to give the operator a proper view of all the units. Thus the average distance between control desk and transmitter in medium power installations is eight to ten feet.

(4) As more units are added to the transmitter, a rectangular, semi-circular, or other "folded" arrangement (see sketches at bottom of pages 10 and 11) becomes desirable to bring all of the units within proper viewing distance of the operator. Such arrangements also make for easy maintenance and use space efficiently.

(5) Not only the transmitter itself, but auxiliaries such as phasing equipment, modulation, frequency, and phase monitors, noise and distortion meters, line and limiting amplifiers, should be visible and readily accessible to the operator.

(6) The auxiliary units listed above must be arranged so that the operator can get in back of them, with ample space for servicing or maintenance.

After layout of the transmitter, control desk, and other units and scaling of the control room, plans should be made for maintaining temperature, ventilation, and lighting in the room, all adjusted to the requirements of continuous occupation by an operator. Proper lighting of the front of the transmitter will add measurably to the appearance of the equipment and the efficiency of operation.

Acoustic treatment of the control room walls and

ceiling has become general practice, to lower the noise level with consequent improved program monitoring efficiency and additional comfort for the operator.

A feature of the control room often overlooked is the provision of convenient space for a typewriter. Standing a typewriter on the control desk puts it in



Gas equipment for pressurizing transmission lines and high voltage condensers can be put in basement or near back wall of building.

the way of other operations and makes it inconvenient to use.

When the preliminary layout of major units of equipment in the transmitter room and control room is on paper, attention should be turned to planning for proper and economical installation of the following "services" to the transmitter and associated equipment:

- Incoming primary power
- Incoming program lines
- Interunit connections
- Outgoing transmission line
- Lighting circuits
- Cooling water piping (if water cooled)
- Air ducts for cooling (larger air cooled transmitters)
- Gas equipment for pressurizing transmission line

It is in the placement and arrangement of these items that many buildings go wrong, with consequent expensive alterations, or inefficiency caused by difficult maintenance and operation. Your technical specialist, and your architect or building contractor must work closely together in making thorough advance plans for installation of all these services to the transmitter. For such planning, "accurate and complete installation drawings of the transmitter and auxiliaries are priceless to the designer," says J. L. Middlebrooks. "They are the best insurance against costly hindsight architecture."

Each building and each transmitter will present an individual problem, but the following general considerations should be noted:

Terminal boards and overload control points, such as power distribution panels, fuse boxes, circuit breaker panels, should be placed so that they are readily accessible to the operator on duty.

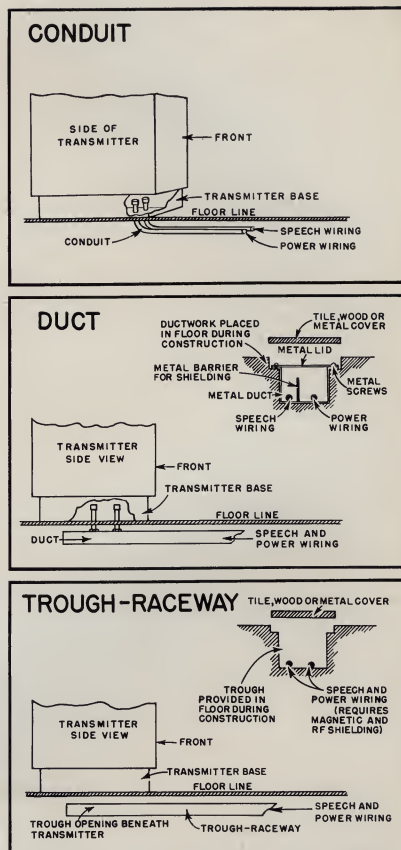
Incoming program and power lines should be brought in to separate, centrally located terminal boards. If these lines run near your AM antenna, you should consider burying them, to reduce interference problems.

Interunit connections should be planned with particular care. A drawing showing every electrical and transmitter circuit in the building should be prepared, to provide assurance that plans have been made for all necessary circuits.

The builder has a choice of a number of methods for installing interunit power and audio circuits:

(1) **Conduit:** Commercially available conduit can be (a) buried in poured cement floor, after which relocation of wiring is difficult and costly; (b) run under the floor if there is a crawl space or basement, in which case changes require cutting holes in the floor and disconnecting the conduit; (c) run under false floor. A double floor permits the conduit to be laid between the two floors.

(2) **Ductwork:** Many forms of metal ductwork are commercially available and this is a very popular device for installing interunit wiring. Duct in general has a rectangular cross section and removable top. Many types are supplied with an integral shielding barrier which can be used to separate speech circuits from power circuits, making other shielding unnecessary. The sketches at the right show typical methods of installing ductwork. The



Practical methods for installing interunit wiring are shown in above sketches. All of them are adaptable to a variety of floor constructions.

removable top makes for easy maintenance or alteration in the wiring at any point along the duct. It can be: (a) laid in poured concrete floors; (b) installed under false floors; (c) hung from the floor if there is a crawl space or basement.

(3) **Troughs or Raceways:** Troughs or raceways formed in poured cement floors provide another method for installing interunit wiring. The wire can simply be laid in the trough. Some kind of top cover must be added, and if speech and power cir-

cuits, or high and low level circuits, are run in the same trough, shielding is required.

Convenience outlets near each of the major units of the transmitter for operation of test equipment, small power tools, trouble lamps and soldering irons should not be overlooked. Some manufacturers supply such outlets in the transmitter cabinet.

After design of the transmitter room and control room, the other building units can be added to the plan. These are discussed below.

Washroom: The FCC requires that a washroom be installed close enough to the operator on duty so that he will not find it necessary to be away from the control point more than a few minutes at any time. No stipulation as to the exact distance from the control desk is made nor is it required that the washroom open directly into the control room. However, if the operator has to go to the end of a long corridor, or to another floor a considerable distance from the transmitter, it is considered a case of bad practice in this respect.

Storage Space: No transmitter building can operate efficiently without storage space. Spare tubes, test equipment, replacement parts are essential and should not be piled in the corner of the room because nothing better has been provided.

In estimating the amount of storage space needed, it pays to go well over on the generous side. The "Survey Study of Broadcast Transmitter Buildings" which is presented beginning on page 36 gives definite information on the value of storage space, as determined by the experience of broadcast stations in all parts of the country. Among the six hundred stations answering the questionnaire, the most frequent lack mentioned in describing the transmitter building was "insufficient storage space." This makes it plain that storage space is commonly underestimated in stations of all ratings.

In larger stations specialized storage schemes may offer benefits. With a high power transmitter, for instance, the tube storage can be arranged on a functional basis, with racks constructed to hold an exact duplicate set of the tubes in the transmitter, arranged in corresponding order.

One type of storage sometimes overlooked is *storage for reports and other papers*. Ordinary file cabinets will be satisfactory. Built-in cabinets, conveniently located, make an attractive solution.

Further improvements in efficiency and conven-

ience can be achieved with the following specialized types of storage:

- (1) Racks or drawers for safe storage and easy removal of the numerous blueprints needed in a broadcast station;
- (2) Closer and lockers for clothes and personal belongings of operating personnel;
- (3) Bookshelves or racks for engineering refer-



Workshop at WTOP has ample bench space with covered storage below the bench. Note natural and artificial lighting over working area.

Another well-planned shop, this one at WHEC, Rochester, has plenty of open and closed storage, drill press, vise, and test equipment.



ence books and periodicals and equipment catalogues. A "library corner" in the office or other convenient space is a great help to neatness and order, and puts the reference tools in a known location where they can always be found quickly by the operating force.

Work Shop: A shop consisting of a regularly equipped bench with adjacent storage space for tools and small parts should be included in every broadcast transmitter building.

The tools most commonly needed are the small tools ordinarily used in repairing or rewiring electronic equipment, plus a drill press and heavy vise. In the larger stations a small metal lathe may be useful, but the completely equipped machine shop has been found to be unnecessary by the great majority of broadcast stations. Covered storage space to keep dust off of expensive test equipment, should be included in the shop. *With FM transmitters, and AM transmitters of 1 kw and lower power,* shop, storage space and transmitter room, or shop and heater room, may be conveniently combined. *With AM transmitters above 1 kw* it is usually dangerous to have personnel working at a bench directly in back of the transmitter. No one should work in the near vicinity of a high-power radio transmitter unless his full attention is on the transmitter. In addition, the safety regulations may require that the area in back of the transmitter be within an "interlocked" enclosure.

Office: Usefulness of an office even in smaller stations arises from the record-keeping activities that are imposed by law on every broadcast station. Storage of records and a place to prepare the required reports are just two of the functions that make an office desirable. It is possible to combine the office with other functions, such as the visitors' lobby or the operators' lounge (see plans, Sec. II).

There is another kind of value arising from the inclusion of an office for the chief engineer or transmitter supervisor. The technical heads of a broadcast station have a professional standing which should be an integral part of their thinking about their jobs, and should be recognized by the management and the general public. Proper office facilities are important in maintaining this valuable frame of mind for both the technical men and for those in contact with them.

Shower Room: After more storage space, the

shower room was one of the features most often mentioned as desirable by the persons answering the Survey questionnaire.

Kitchenette: This is another convenience which has universally proved itself in the minds of operators, owners and builders of transmitter buildings, as revealed in the Survey. Naturally in a building with living quarters, a complete kitchen must be included. However, in the buildings without living quarters or regular kitchens, the single unit kitchenette with stove, sink, storage and refrigerator all in one compact, relatively inexpensive piece gives the operators a place to "boil up a bite" while on duty. This has proved particularly valuable for operators on all-night watches.

Emergency Studio: Every broadcast transmitter which is separated from its studios faces the possibility of being cut off from the program source. Prolonged time off the air can be avoided if provision is made in the transmitter building for emergency program production. Various arrangements at the transmitter building will allow the station to get on the air on a more or less minimum basis:

(1) *Turntable and speech input facilities added to transmitter control desk.* This is the simplest arrangement and will generally be satisfactory for recorded music programming. The use of a microphone at the control desk may be unsatisfactory without acoustic treatment of the control room. The noise level produced by air cooling equipment of some transmitters may make a glass isolation screen in front of the transmitter desirable.

(2) *Turntables and speech equipment at transmitter control desk, with a separate acoustically treated room for microphone pickup.* With a microphone pickup room adjacent to the control room, a properly placed viewing window will make it possible for the transmitter operator to operate the turntables, and to control the live pickup, without leaving his position.

(3) *Complete emergency studio.* Naturally there is no limit, except the resources and needs of the station management, to the completeness of the studio equipment installed in the transmitter building. For the average medium-power station, which has no unusual programming methods or operating problems, an emergency studio along the lines of those in the plans on pages 30 and 33 has been found satisfactory.

As shown in the plans referred to, the turntables, speech control equipment, and live pickup are all in the studio together. The studio adjoins the transmitter control room with a viewing window between the two. This arrangement works well with the simple type of program production to be expected for emergency use in a station of this type. In a regular studio, of course, the much more complicated program control necessary would not permit the audio control man to sit with his back to the microphone positions, and within the studio space.

Garage: The need for a garage at the great majority of transmitter buildings is obvious. Additional parking space is a further convenience for visitors and personnel.

Living Quarters: The provision of living quarters for at least a part of the operating personnel will pay off in many locations which are so inaccessible as to make regular daily coming and going of the operating force difficult and time-wasting. The widespread use of living quarters as a part of the transmitter building, either from necessity or to increase the efficiency and attractiveness of the building for the operating force, is clearly indicated in the Survey results on pages 38 and 39.

Employees' Lounge: The employees' lounge is another building unit which adds greatly to the convenience of the building for the operating force. It can be combined with the office, as shown in the plans on pages 25 and 30.

Heater Room: The trend to single-floor layouts brings the separate heater room to the fore as a feature of the main floor plan in nearly every building in climates where heating is required. In the smaller stations, the heater room can be combined with shop and storage (see plan, page 25).

Transformer and Power Distribution Room: The larger transmitters using separate high voltage equipment introduce the necessity of constructing separate rooms or enclosures which embody the safety and isolation characteristics required by FCC and Underwriters' regulations, and good engineering practice, as already explained on page 11. Interlock systems and other safety measures for such rooms will ordinarily be specified for each transmitter by the manufacturer. The planner of the layout must take care that interlocked high voltage

When Planning and Constructing a Broadcast Transmitter Building . . .

DO

- ☐ Check local zoning restrictions.
- ☐ Consult C.A.A. on tower height.
- ☐ Secure complete installation information from transmitter manufacturer.
- ☐ Allow room for expansion, if this is contemplated.
- ☐ Check building plans with fire insurance consultant to get lowest rates.
- ☐ Check rainfall, snowfall, wind conditions, temperature range, etc. at site.
- ☐ Have doors wide enough for moving in equipment.
- ☐ Plan location of all interunit wiring before construction begins.
- ☐ Provide enough work shop and storage space.
- ☐ Provide sleeping facilities, if only for emergency use.
- ☐ Arrange to keep temperature in operating areas at comfortable level for personnel.
- ☐ Provide dirt-free air for transmitter and operating areas.
- ☐ Isolate transmitter heat from building cooling system.
- ☐ Provide kitchenette facilities, particularly if food is not available nearby.
- ☐ Place convenience outlets near all equipment.
- ☐ Provide rack space for all the audio and test equipment you will need.
- ☐ Ground any large conducting parts of building frame.
- ☐ Make your building an attractive, efficient home for your transmitter—and a building in which employees will enjoy working.

DON'T

- ☐ Select a site until you have checked costs of roadways, building services and utilities.
- ☐ Plan other rooms until you have laid out transmitter room and control room.
- ☐ Place wash room at too great a distance from control desk.
- ☐ Buy land for AM site without considering need for directional array in the future.
- ☐ Use building power circuit which is subject to heavy, irregular loading by other tenants.
- ☐ Put high-voltage units or wiring where they will endanger personnel.
- ☐ Place "interlocked" areas so they block normal access to other rooms or equipment.
- ☐ Put audio and power lines in same raceway without shielding.
- ☐ Allow small metal parts in building to become hot from induced r-f energy.
- ☐ Put up a transmitter building in your community which misrepresents you and the character of your business.

areas do not interrupt the normal operating flow of the building, nor interfere with the maintenance of equipment which must for any reason be attended while the transmitter is in operation.

There are many solutions to the problem of isolating dangerous high voltage equipment from parts of the transmitter which must be attended. The completely enclosed and interlocked transmitter room is shown in the plan on page 33. The use

of a chain link fence is shown in the plan on page 47. Others will be noted in the various plans in Sections II and IV.

Viewing Lobby and Visitors' Lounge: The general problem of deciding what provisions should be made for the public has already been discussed on pages 9 and 10. The viewing lobby is a popular form of public relations effort, for the reason, often pointed out, that transmitting equipment has beauty and drama for the general public. A transmitter

with the circle or "U" of units facing the operator, the high-power amplifier tubes visible through the front panels, and the rows of meters and controls, is impressive to any onlooker. The viewing lobby can be combined with an attractive lounge.

Naturally if you are going to show your building to the public the operating area should be neat and straightforward in arrangement. The appearance of precision and efficiency which a well-arranged, well-kept transmitter area gives the onlooker can be a valuable goodwill agent for any station.

D. TECHNICAL ACCESSORIES TO THE BUILDING

There are a great number of technical features that can be added to a transmitter building, the choice of which will be determined in most cases by individual needs, as interpreted by the technical specialists working on the building. A few of the most generally valuable features of this type are discussed here.

Emergency Power: The chance of losing air time due to primary power failure can be minimized in two ways:

- (1) Installation of standby diesel or gasoline-engine driven generating equipment large enough to operate the transmitter and auxiliaries. Such generating equipment should usually be placed in a separate building, for lower insurance rates.
- (2) Provision of alternate power run, or connection to entirely separate commercial source, if such is available.

Emergency power has strongly proved its value in the experience of many broadcast stations.

Communication System: Communication between different parts of the building becomes important in the larger buildings. Telephones for outside calls and building intercom should be placed on the control desk. In particular, a telephone line from the control room to the base of the antenna towers, in directional arrays, will greatly facilitate adjustment of the antenna system.

Recording Room: In combination studio-transmitter buildings, where disc recording is to be done regularly, a stable floor in the recording room is essential. Various construction methods are avail-

able for giving the floor a very low period of vibration and insulating it from disturbances in the rest of the building.

Shielded Test Room: In the higher frequency stations—FM and television—a shielded test room may be found valuable, to eliminate errors in adjusting monitoring and test equipment. The conventional grounded "chicken wire" booth is usually satisfactory.

Your control room can "work" for you with the public, as shown by this beautifully arranged and decorated room at Station WWJ, Detroit.



E. BUILDING SERVICES—CONSTRUCTION METHODS

1. Heating the building — Waste transmitter heat

Transmitter buildings in colder climates can be heated by any of the conventional methods, but hot air and radiant systems have proved the most popular types. Insulation pays off in transmitter buildings in the same way as in other types of buildings.

The subject most discussed in this connection is naturally the use of waste transmitter heat to heat the building. The system has received widespread application, as can be seen in the Survey tabulations on page 38. Many successful installations of this type have been made which have proved to be economical and practical. However, before you plan to use it, your architect and heating engineer should give careful consideration to the following:

(a) In colder climates, waste heat should not be relied on as the *sole* means of heating the building. Most broadcast transmitters are turned off a part of the time, *whereas in cold weather a building must be heated continuously.*

(b) In most cases in colder climates, the waste heat should be used to *supplement* the regular heating system rather than the other way around, since the regular heating system must have full capacity for those periods when the transmitter is turned off.

(c) In summer, the waste heat must naturally be discharged outside the building. This means that a system of control must be installed which can be used to discharge the waste heat outside in the summer, and utilize it in the building in the winter. When correlated with an air conditioning system for summer cooling (see below) this can become an elaborate and expensive system.

(d) A careful study of the cost of the required control systems sometimes shows that it is cheaper to exhaust the waste heat outside the building, winter and summer, and rely on a conventional heating system for the building.

2. Cooling the building

Whether or not a system is installed for cooling the building by mechanical refrigeration will be determined by the climate and by the resources of the management. *Wherever hot summer tempera-*

tures are encountered, a complete conditioning system for cooling the building and filtering the air will promote efficiency of personnel and will pay big dividends in increasing the reliability of the equipment. The minimum should be a system for exhausting the air of the whole building in summer, with provision for entry of filtered air to replace that moved out.

As pointed out on page 14, transmitter waste heat should not be loaded on the building mechanical refrigeration system if it is possible to avoid it. With the larger transmitters, provision *must* be made to isolate the transmitter heat from the building cooling system in the summer.

3. Construction methods and building materials

The construction methods for a broadcast transmitter building are in most respects the same as those for other types of buildings of similar size. Choice of materials will depend on cost and availability, on building ordinances, and on the desires and resources of the station management.

Reinforced concrete and brick are the two most popular forms of construction for the larger buildings. Fieldstone, alone or in combination with concrete or wood, is economical in many areas, and can produce a substantial, attractive building that has a strong harmony with its surroundings.

Many of the smaller buildings are very satisfactorily built mainly of wood. The original design for a 250 watt AM station on pages 24 and 25 shows what an attractive and efficient building wood construction will produce when combined with brick inner walls. Wood in combination with concrete is another attractive possibility.

Your listeners want to see your transmitter building. KRSC invited them in for a good look around on opening night, as shown below.



On pages 12 and 13 several simple "utility" types of construction are shown. The "utility" building has been of particular value during the war and early post-war years. It permitted many stations to get on the air which would otherwise have lost their chance to get into the business. Building block, converted wood structures, and various types of prefabrication have all played their part during this period when building was difficult.

Fireproof construction is valuable not only as a safety measure, but in lowering insurance rates. To make sure of getting the best possible construction from the Fire Underwriters' point of view, have your building plans examined and recommendations made by a fire insurance consultant.

It is required by the Underwriters' and FCC regulations that the metal frame of a transmitter and all associated equipment, as well as the frame of the transmitter building itself, be thoroughly grounded as a protection to operating personnel. In some cases this is combined with the r-f ground for the transmitter. No large conducting bodies in a transmitter building should be left ungrounded. If metal lath is used on the walls, this should be bonded together at a number of points and con-

nected to the grounding system, to form a practical shield against r-f energy.

A hazard often overlooked is the induction of r-f energy in small metal parts of the building frame with consequent dangerous temperature levels, particularly when the antenna is close to the building. This applies especially to AM stations of higher powers, *but it remains as a possibility even with lower power AM stations and FM stations of all powers.* Wooden buildings with composition roof are more often subject to this kind of danger. Heating of the nails in the roof or floors of the building may require some form of shielding or grounding system to eliminate a definite fire hazard.

4. Landscaping

The landscaping of a transmitter site will naturally follow the ideas and desires of the station management. Do not forget that the landscaping plays a major role in the idea that the public forms of your station, as already pointed out on page 10. It can be a very positive element in the public relations program of the station. The Survey tabulation on page 38 shows average expenditures for landscaping by stations throughout the country.

F. THE STYLE OF YOUR TRANSMITTER BUILDING

Finally, you must be satisfied that the whole style of your building truly fits in with what you want your station to be. Permanently satisfactory architectural style is based on two principles: (a) It follows naturally from the interior shape and function of the building; (b) it has some pleasing order or harmony in the exterior, which fits in with the site and with the materials used.

Because a radio transmitter is a very modern phenomenon, it seems appropriate that the transmitter building should usually follow a style belonging within that broad range roughly known as "contemporary". However, as shown on pages 12 and 13, many styles are possible, and the important thing is that the building follow your own needs, desires, and expectations of the future.

It is here that a less tangible element enters into the planning of your transmitter building, an element strongly personal but nevertheless inseparably

connected, over the long run, with the success or failure of your business. This is the sense of permanence, of pride, of personal identification with the standing of your business in the community, which should be expressed in many ways, and certainly in a substantial and beautiful transmitter building. It is easy to pick out, in broadcasting as in other businesses, the organizations that achieve long-range success. Every aspect of their equipment expresses this same sense of permanence and pride.

You have read this guide because you know that getting on the air with a broadcast station is a large undertaking, involving a considerable investment of money and effort. You understand that you cannot afford to let your transmitting equipment operate in a building that is badly planned and carelessly built. Your hopes for the future should be built around a really fine transmitter building. Can you afford anything less?

SECTION II

Transmitter Buildings With a Future

SIX ORIGINAL PLANS DESIGNED BY

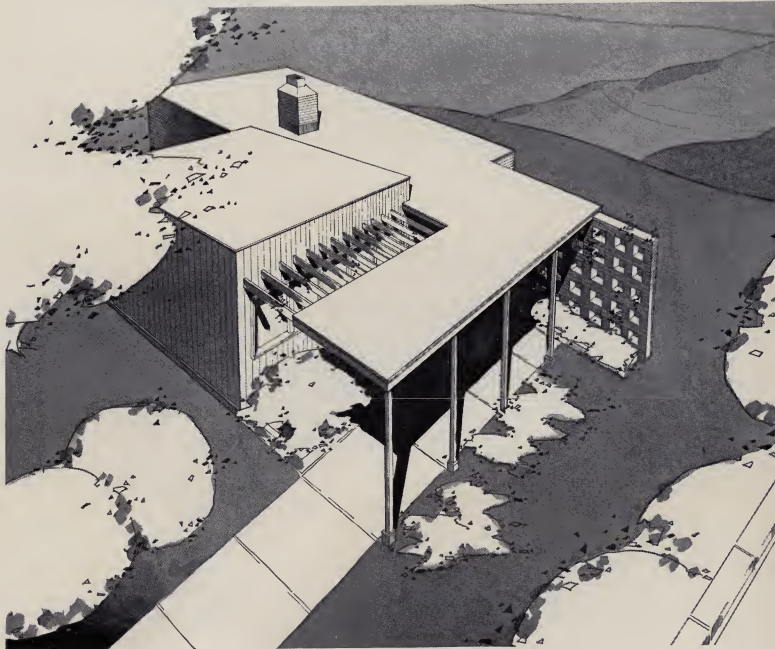
DEIGERT AND YERKES, ARCHITECTS, WASHINGTON, D. C.

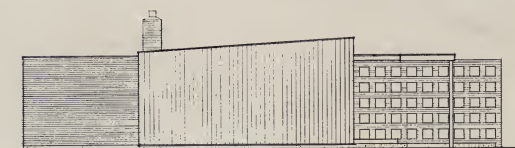
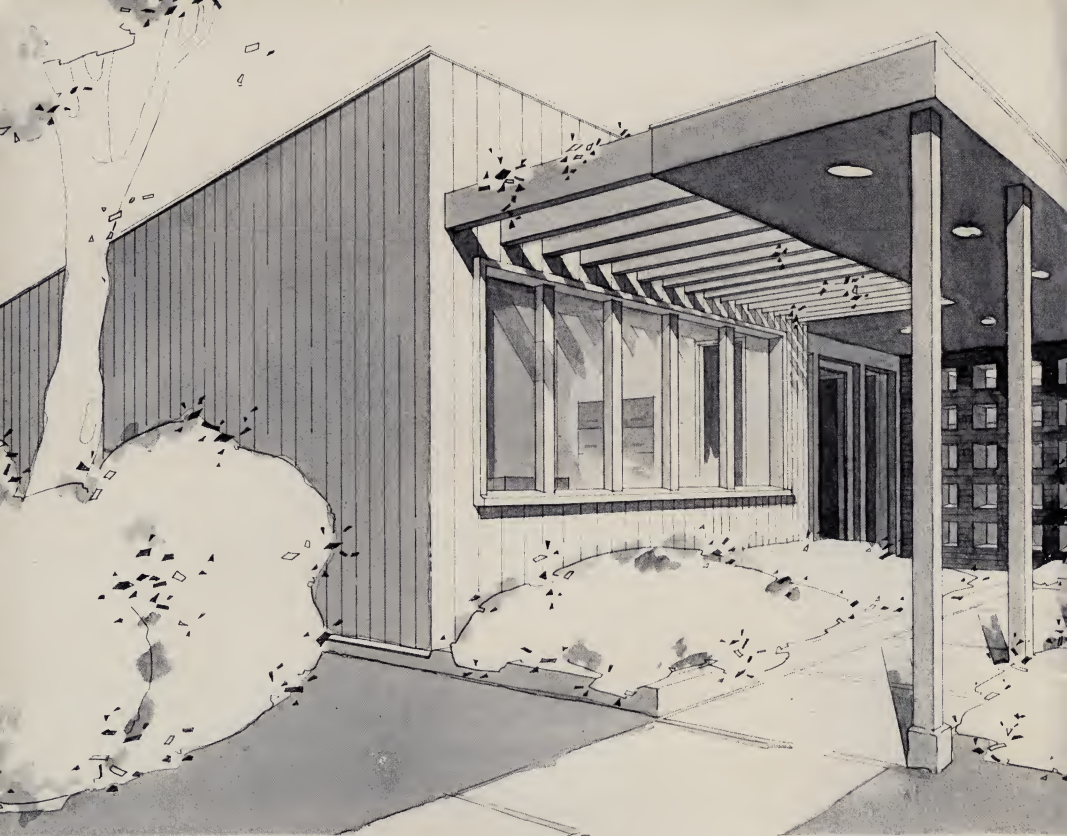
AND PRESENTED TO THE BROADCASTING INDUSTRY BY

Western Electric

**250
WATT
AM**

This modern building of wood and brick is shown with floor plans, elevations, construction details on next two pages. Perspective drawing at right shows roof plan and handling of entrance.





PRELIMINARY ELEVATION STUDIES



**SUGGESTED FACILITIES
FOR EQUIPMENT WIRING**



250 WATT AM

FEATURES

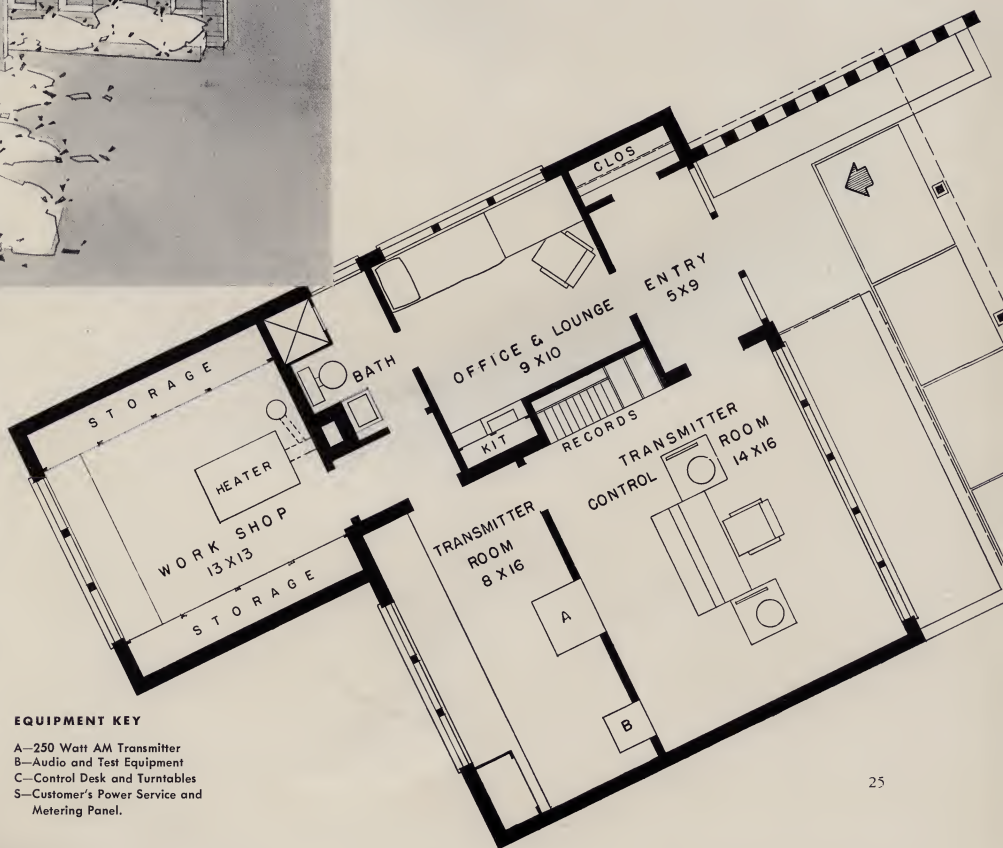
This plan provides for efficient operation of a small transmitter in compact space. Filing cabinets and transcription storage built into control room wall. Unit kitchen and desk in lounge, which also has bed for overnight emergencies.

CONSTRUCTION OUTLINE

FLOOR—Concrete slab. Crawl space under transmitter and control rooms. WALLS—Exterior, partly stud, partly 8" brick, with exterior finish vertical red-wood siding. Interior acoustically treated in Control Room, other spaces plaster or plywood. All exterior masonry walls are turreted. ROOF—Frame construction; built-up tar and gravel over wood deck. WINDOWS—Wood casements and fixed glass. HEATING—Radiant heating in floor slab.

TRANSMITTER

Western Electric 451A-1, 250 Watt AM. For dimensions and other data see page 56.



LOCATION

This plan utilizes space in existing office or hotel building. Room sizes will vary from building to building. Dimensions listed are average for structures of this type.

FEATURES

Storage space and work shop are adjacent to transmitter room, but separated from it. Additional built-in storage for papers, etc., is provided in lounge. Unit kitchenette in lounge is optional—will be particularly valuable if all-night programming is contemplated.

CONSTRUCTION OUTLINE

FLOOR—Usually concrete. Finished with linoleum or

rubber. WALLS—Interior partitions are usually concrete block or tile, plastered. Control room walls and ceiling are acoustically treated. TRIM—Flush steel trim. HEATING AND AIR CONDITIONING—As furnished by building.

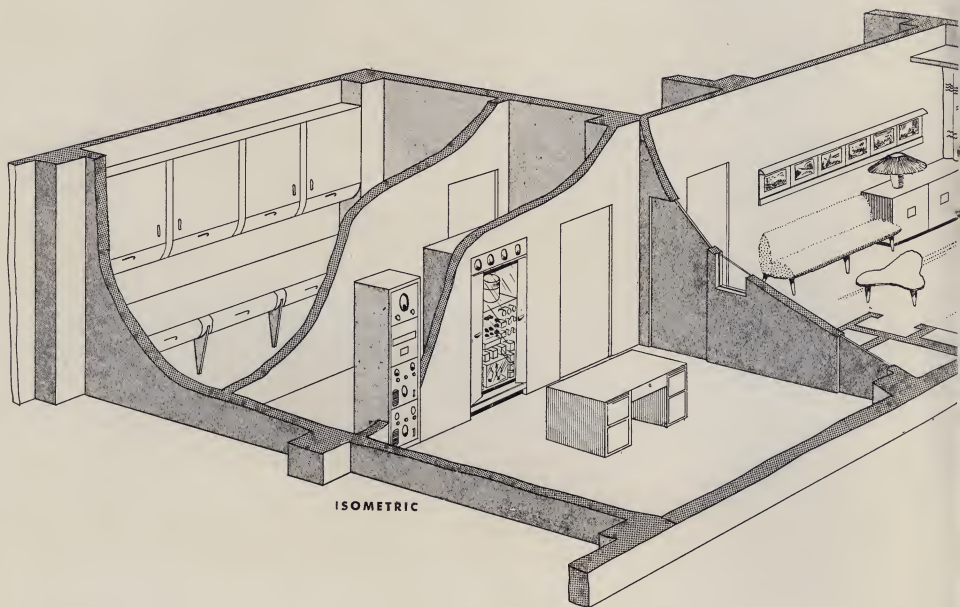
TRANSMITTER

Western Electric 501C-2, 250 watt FM. For dimensions and other data, see page 57.

ALTERNATE FLOOR PLAN

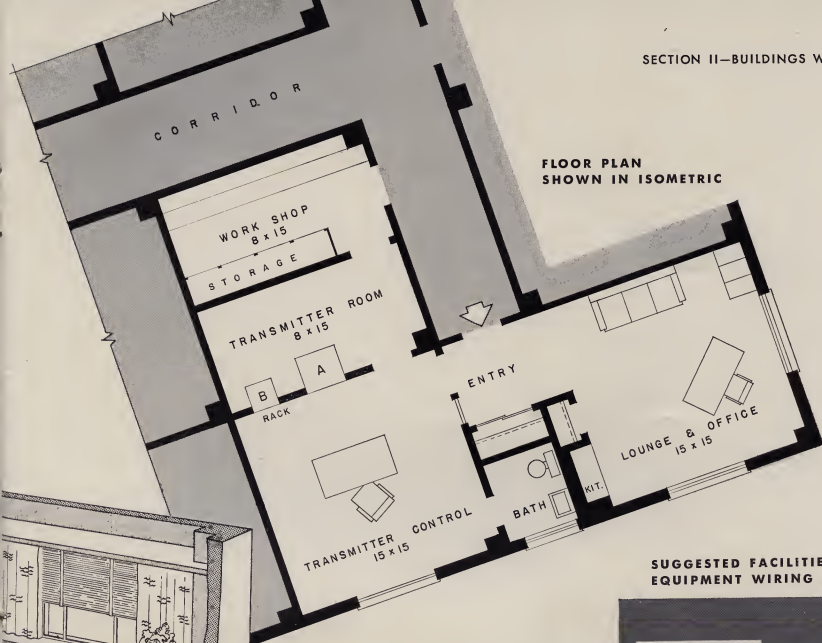
Provides studio for live broadcasts, in addition to facilities included in other plan. Also provides spacious entry and viewing lobby, with viewing windows into control room and studio. Control room controls both transmitter room and studio.

250 W FM

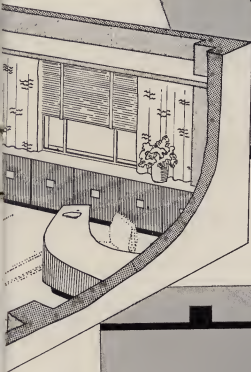


The arrangement shown above includes transmission facilities only, located on an upper floor of the building. Studios and transcription turntables can be located in adjacent rooms or on a lower floor of the building.

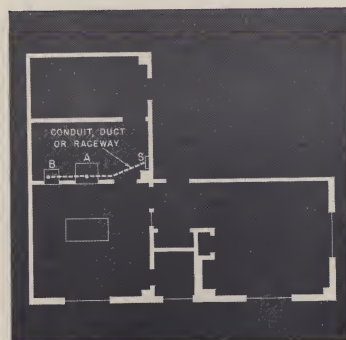
The alternate floor plan at right fills approximately the same building space, but is rearranged to include minimum studio requirements for a 250 watt FM station. Transmitter room and shop have been combined and the control room has been made smaller to provide studio space. Small room opening off the office may be used as wash room.



FLOOR PLAN
SHOWN IN ISOMETRIC

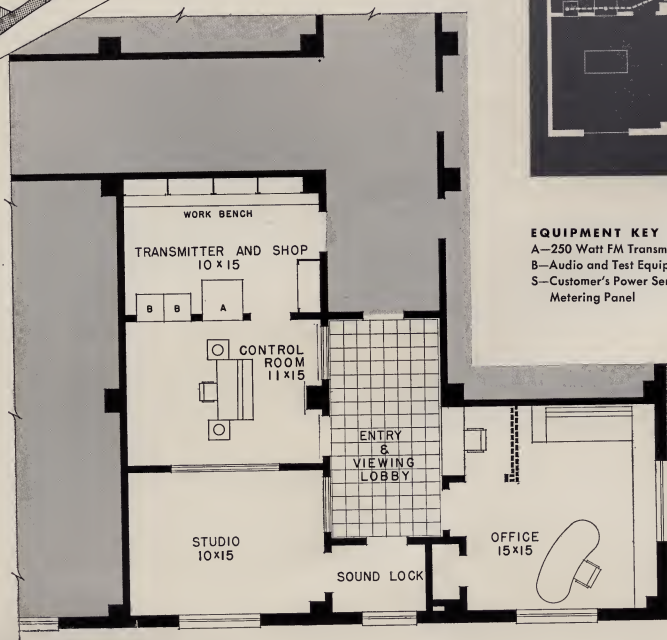


SUGGESTED FACILITIES FOR
EQUIPMENT WIRING



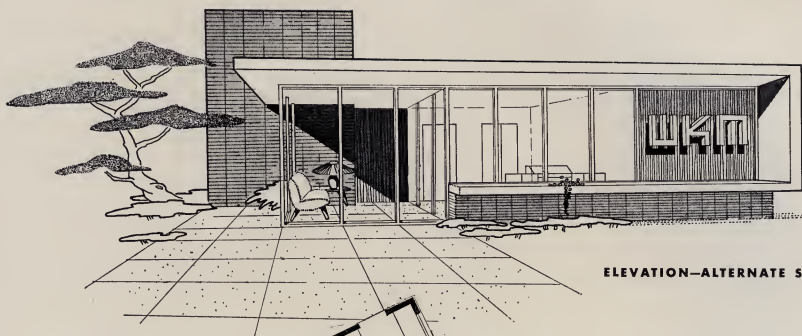
EQUIPMENT KEY

- A—250 Watt FM Transmitter
- B—Audio and Test Equipment
- S—Customer's Power Service and Metering Panel

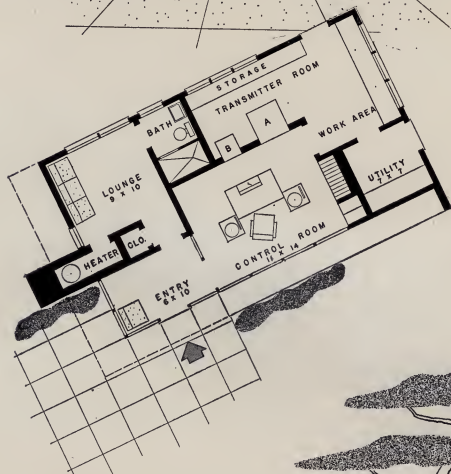


ALTERNATE
FLOOR PLAN

1 KW AM



ELEVATION-ALTERNATE SCHEME

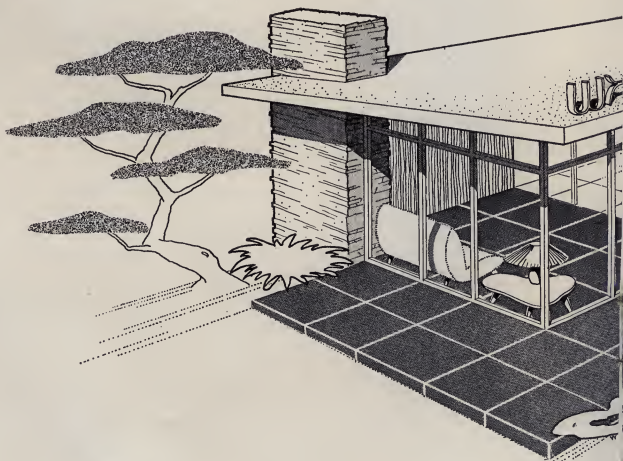


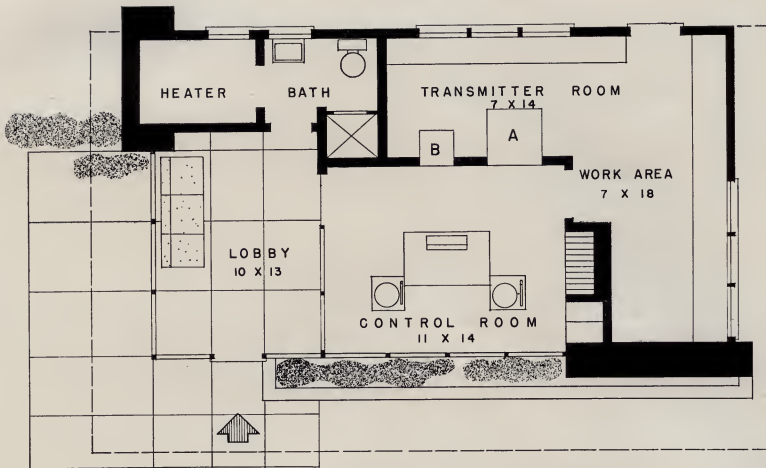
FLOOR PLAN
ALTERNATE SCHEME

ALTERNATE SCHEME

Provides most of the features shown in the floor plan at the right and the perspective drawing below, but adds a small lounge which can be used as sleeping quarters when necessary.

Construction and materials are the same, except for the following: WALLS—Exterior walls are partly stud, partly 8" brick. Outer surfaces of exterior stud walls are waterproof plywood, the joints covered with wood battens. Exterior masonry walls are furred.





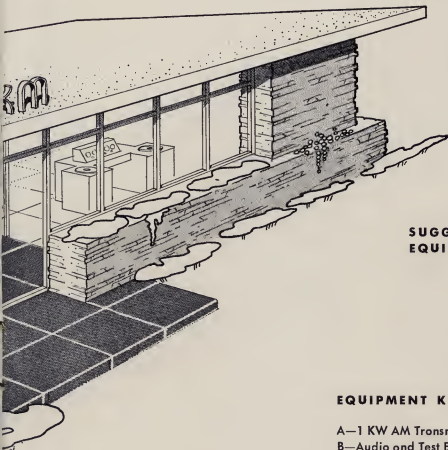
EQUIPMENT KEY: A—1 KW AM Transmitter B—Audio and Test Equipment

FEATURES

Compact plan provides minimal recommended facilities. Transmitter room and work shop are combined. Filing cabinets and transcription storage are built into wall of control room. Glass walls between lobby and control room permit viewing by visitors. Large windows provide uninterrupted view of transmitter and control room from outside the building.

CONSTRUCTION OUTLINE

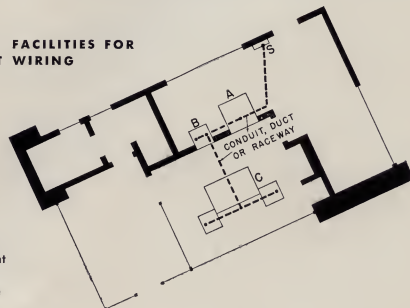
FLOOR—Concrete slab, finished with asphalt tile or rubber. WALLS—Exterior walls are partly stone, partly stud covered with redwood siding. Interior walls and ceiling of control room are acoustically treated; other interior wall surfaces are plastered or covered with plywood, except that stone walls are left exposed. ROOF—Frame construction; built-up tar and gravel roofing over wood deck. WINDOWS—Wood casement and fixed glass. In colder climates Thermopane will minimize heat loss through large glass areas. HEATING—Radiant heat in floor slab. AIR CONDITIONING—Cooling system for control room and lobby.



TRANSMITTER

Western Electric 443A-1, 1KW AM. For dimensions and other data, see page 56.

SUGGESTED FACILITIES FOR EQUIPMENT WIRING



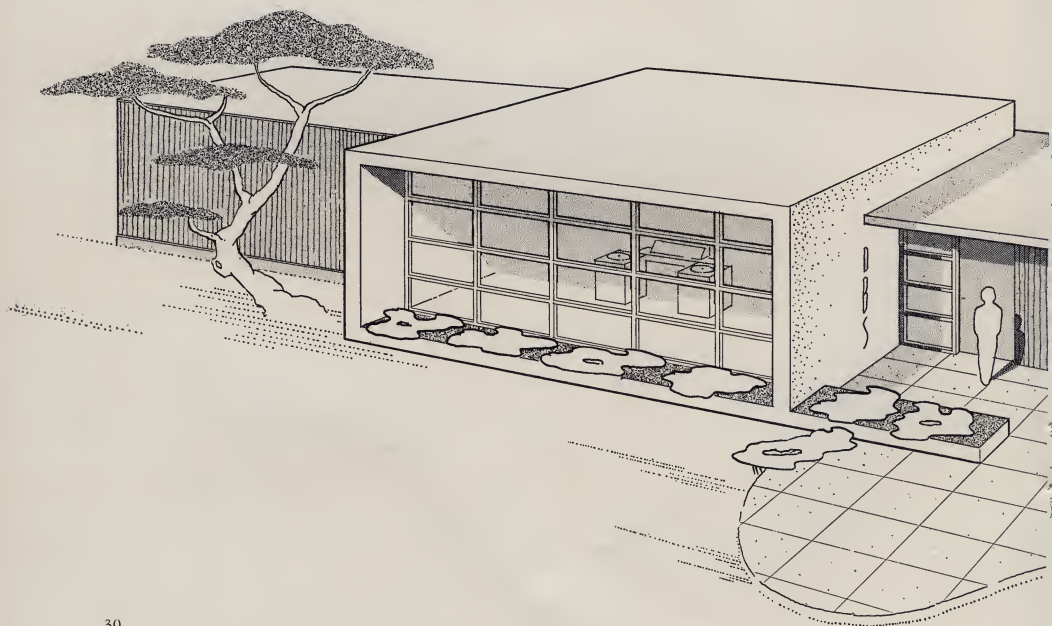
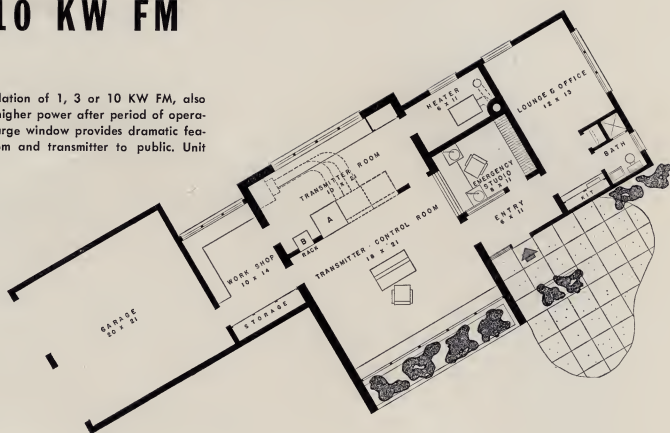
EQUIPMENT KEY

- A—1 KW AM Transmitter
- B—Audio and Test Equipment
- C—Control Desk
- S—Customer's Power Service and Metering Panel

1, 3 OR 10 KW FM

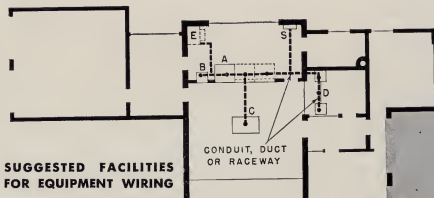
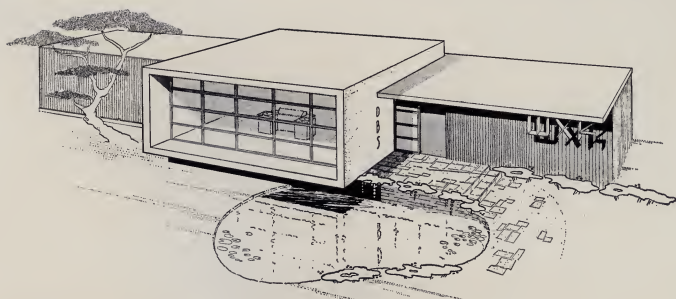
FEATURES

Building for permanent installation of 1, 3 or 10 KW FM, also allows for easy expansion to higher power after period of operation with 1 KW transmitter. Large window provides dramatic feature and displays control room and transmitter to public. Unit kitchen is included in lounge.



EQUIPMENT KEY

- A—1 KW FM Transmitter
(Units added to 1 KW to make 3 KW or 10 KW are shown with dotted line)
- B—Audio and Test Equipment
- C—Operator's Desk
- D—Speech Input Console and Turntables
- E—Electrostatic Precipitator.
(optional with 3 and 10 kw)
- S—Customer's Power Service and Metering Panel



ALTERNATE SCHEME

Perspective above and floor plan below show alternate arrangement with central part cantilevered over decorative pool at building entry.

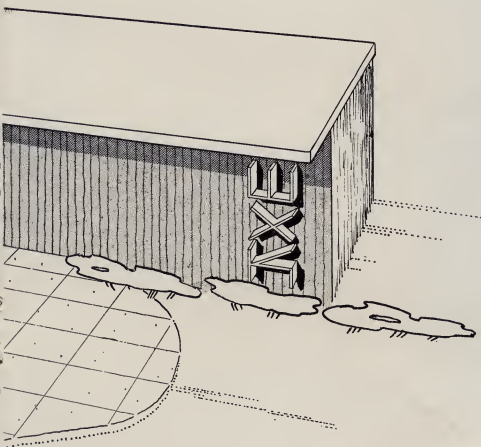


CONSTRUCTION OUTLINE

FLOOR—Concrete slab, with asphalt tile, linoleum or rubber. **WALLS**—Exterior, central part of reinforced concrete or concrete block faced with stucco. Exterior of wings, frame covered with vertical redwood siding. Interior partitions are stud. Control room and studio acoustically treated. Other walls plastered or finished in plywood. **ROOF**—Central part concrete, wings of frame construction. Roofing built-up tar and gravel. **WINDOWS**—Fixed sash in control room. Wood casements elsewhere. **HEATING**—Radiant heating in floor. **AIR CONDITIONING**—Cooling system for control room and studio.

TRANSMITTER

Western Electric 503B-2, 1 KW; 504B-2, 3 KW; or 506B-2, 10 KW FM. For dimensions and other data, see pages 57 and 59.



5 KW AM



FEATURES

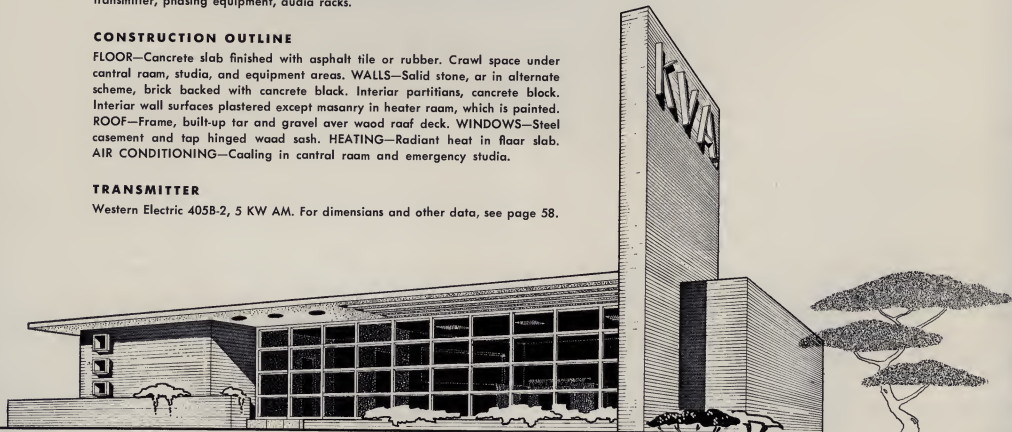
Large window area displays equipment in control room to public. Pylon and call letters are dramatic features which advertise station. Operator has view of studio, transmitter, phasing equipment, audio racks.

CONSTRUCTION OUTLINE

FLOOR—Concrete slab finished with asphalt tile or rubber. Crawl space under control room, studio, and equipment areas. WALLS—Solid stone, or in alternate scheme, brick backed with concrete block. Interior partitions, concrete block. Interior wall surfaces plastered except masonry in heater room, which is painted. ROOF—Frame, built-up tar and gravel over wood roof deck. WINDOWS—Steel casement and top hinged wood sash. HEATING—Radiant heat in floor slab. AIR CONDITIONING—Cooling in control room and emergency studio.

TRANSMITTER

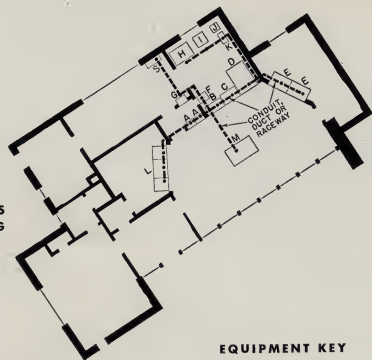
Western Electric 405B-2, 5 KW AM. For dimensions and other data, see page 58.



ALTERNATE CONSTRUCTION—This alternate method uses brick backed up with concrete block for outer walls.



**SUGGESTED FACILITIES
FOR EQUIPMENT WIRING**



EQUIPMENT KEY

- A—Audio and Test Equipment
- B—Control Unit
- C—Oscillator Amplifier
- D—Power Amplifier
- E—Antenna Control Equipment
- F—Automatic Voltage Regulator
- G—Power Distribution Cabinet
- H—Rectifier
- I—High Voltage Transformer
- J—Retardation Coil
- K—Filter Condenser
- L—Speech Input Console and Turntables
- M—Control Desk
- S—Customer's Power Service and Metering Panel



50 KW FM

FEATURES

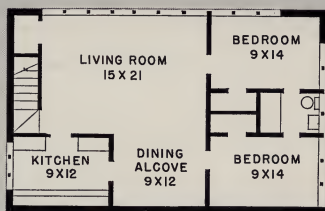
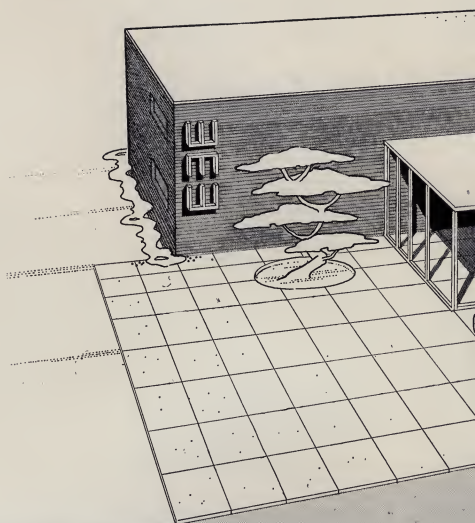
Continuous flow of glass area in lobby and gallery invites inspection of transmitter facilities and equipment by visitors. Employees' lounge on first floor and engineer's living quarters on second floor of main building overlook a private garden area.

CONSTRUCTION OUTLINE

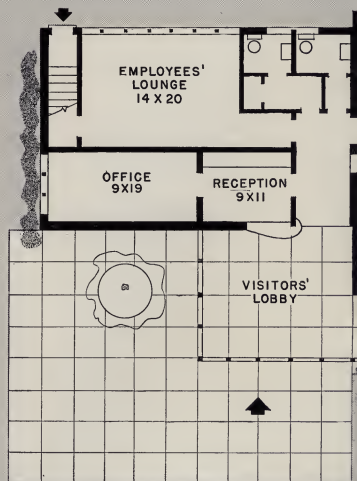
FLOORS—Concrete slab, finished with asphalt tile, linoleum, or rubber. Polished concrete grid forming exterior terrace continuous into lobby and gallery. **WALLS**—Exterior walls of tan-finished brick veneer backed up with cinder block. Interior partitions are of stud construction. Walls of control room and emergency studio are acoustically treated. Other walls plastered or finished with plywood. **ROOFS**—Standard built-up tar and gravel. **WINDOWS**—Fixed sash in control room, operable steel casements elsewhere. **HEATING**—Radiant heating in floor slabs. **AIR CONDITIONING**—Cooling system for control room and emergency studio.

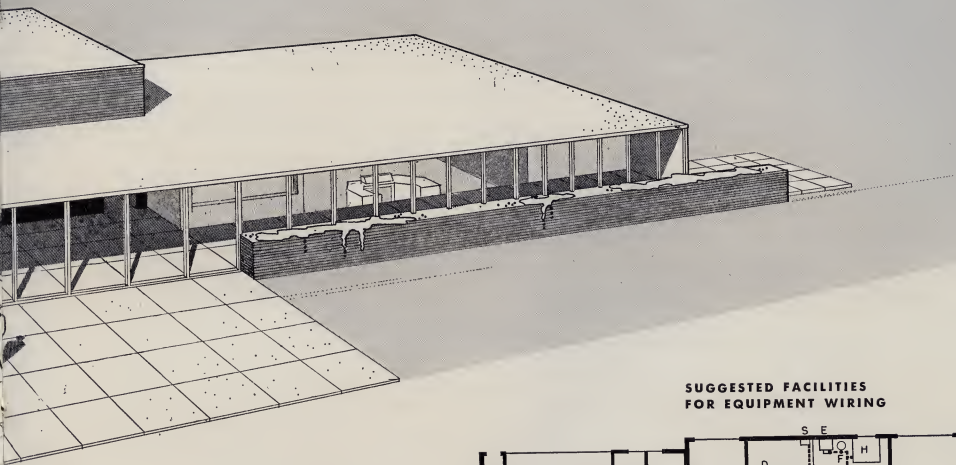
TRANSMITTER

Western Electric 507B-2, 50 KW FM.

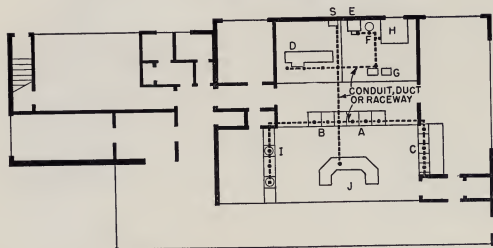


SECOND FLOOR PLAN



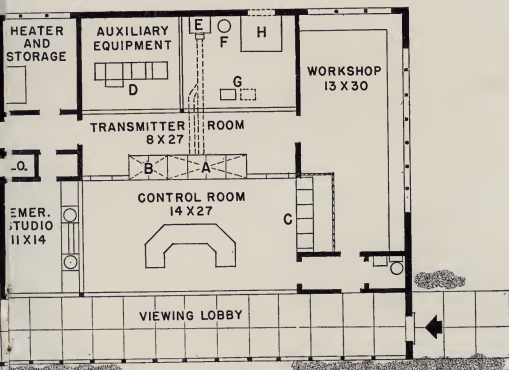


SUGGESTED FACILITIES
FOR EQUIPMENT WIRING



EQUIPMENT KEY

- A—50 KW FM Transmitter
- B—Standby FM Transmitter
- C—Audio and Test Equipment
- D—Rectifier
- E—Electrostatic Precipitator
- F—Water Tank
- G—Water Pumps, Main and Standby
- H—Blower
- I—Audio Console and Turntables
- J—Control Desk
- S—Customer's Power Service and Metering Panel



FIRST FLOOR PLAN

SECTION III

A Survey Study of Six Hundred Ten Broadcast Transmitter Buildings

This is a report on the American broadcast transmitter building—and on the hard-won wisdom of the men who own, manage and operate it. Six hundred such men throughout the industry laid the foundation for this report by answering a detailed questionnaire sent out to discover the characteristics of transmitter buildings for every power rating—how big they are, what they cost, what technical functions and operating conveniences they embody.

The statistical picture of the American transmitter building which these six hundred questionnaires contain has been painstakingly developed by tabulation, recapitulation and analysis, and is presented in the table on pages 38 and 39 of this guide. From the figures shown, it is possible for the first time to generalize about the character of the transmitter building which has developed after two-and-a-half decades of broadcasting in America.

It is evident, for instance, that:

The American transmitter building is most often a single story structure of brick or concrete, in a style which its owners regard as "modern;"

It was built almost entirely between 1935 and the present, with certain classes—in particular the FM stations—built heavily in 1946 and 1947;

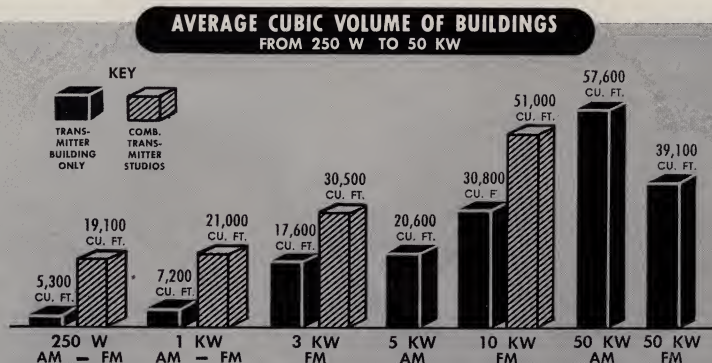
The use of combined studio-transmitter installations is concentrated strongly in the 250 watt stations, of which about half are of this type;

Waste transmitter heat is used to heat building areas in a substantial majority of the buildings covered in the Survey.

These facts and many others are shown in complete detail in the table on pages 38 and 39, which indicates not only the size, cost and type of construction for buildings of each class, but also the building units and rooms, subsidiary to the actual operating areas, which are included in the transmitter buildings covered.

The six hundred station owners, managers, and operators who participated in the Survey have done more than give the dimensions, cost and construction of the buildings they use. They were invited to tell what they *did* and *did not* like about their buildings after the experience of living with them, and they plainly jumped at the chance.

"Inadequate storage space" is the complaint made most often. "I would say that there should be at least twice as much space for storage," is the report from a 250 watt, with 100 square feet of storage space. "We find the amount of storage space we have not nearly sufficient: we think at least 250 to 300 square feet should be provided," comes from a 5 kw AM installation. One particular type of storage mentioned several times was that for a record and transcription library, in a location making recorded program material easy and efficient to use.



Other building facilities of uppermost interest to managers and chief engineers are, in approximately the order named: workshop, shower room, garage, kitchenette, employees' lounge, and living quarters. If the building lacks any of these facilities that lack is apt to be noted; if it has them, satisfaction is generally expressed with the convenience and efficiency of such features.

"We really should have the following features to make our building satisfactory from an operator's standpoint: attached garage, shower room, kitchen and sleeping quarters, extra storage space"—this from a 1 kw AM station.

A 250 watt station with two complete apartments, one at each side of the transmitter and control room, comments: "This duplex arrangement with transmitter between has certainly been a good bet in the last few years."

Among the more graphic warnings noted is one from an FM station on a mountain top: "If we had known about the terrific wind and rainstorms on this mountain, we would have given greater consideration to weatherproofing. The rain drives across the mountain horizontally and went right through the walls, until our special weatherproofing was completed." Another warning based on bitter experience comes in these words from a 250 watt station: "Also fence entire area to prevent trespassing and disturbance of ground system, namely, unlawful removal of same."

A number of the technical features and building services that stand out as winning more or less general acceptance are: air conditioning for the building; high-capacity exhaust fans to move hot air out of the transmitter room; electrostatic precipitators for cleaning the air; emergency power sources; emergency studios.

"Would incorporate in a new building" writes a

The average cost figures shown below and in the chart on the next page are *not* current construction costs, but are averages for the whole period of transmitter building construction going back to about 1930. Today's higher costs show a wide fluctuation from locality to locality, ranging from 50% to 150% higher than the figures shown below.

5 kw AM from Florida, "a solar water heating system, automatic emergency power supply on a separate concrete base to eliminate vibration, and residence for chief engineer."

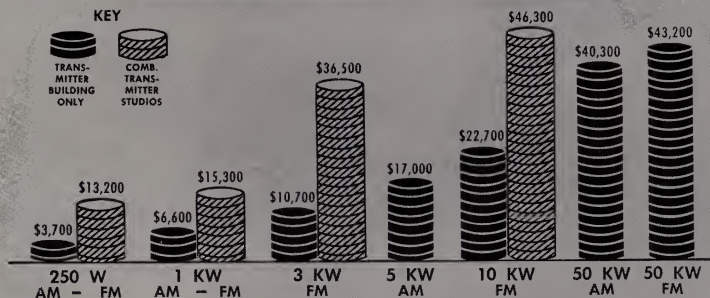
A number of stations comment on the importance of having duct or raceways in the floor to facilitate interunit wiring, a matter discussed in detail on page 16 of this guide.

"The most valuable idea incorporated in the construction of our building is the wiring through the floor, which makes it easy to repair wiring, and the addition or rearrangement of equipment is easily done," comes from a 1 kw AM.

Other technical and architectural features, mentioned as definitely proving themselves in use, include: a water screen on the roof to provide insulation; an enclosed entry to keep dirt from getting in the transmitter room when persons enter the building; glazed tile to make a removable control room wall for easy expansion; bonding and grounding of metal lath to make an r-f screen around the building.

The extent to which transmitters are today housed in temporary structures is borne out by the number of times that a description of "our future permanent building" is offered. The wartime construction difficulties forcing so many stations into emergency quarters, and the continuing expansion of the industry, make it certain that transmitter buildings are going to be erected in enormous volume in the next few years.

AVERAGE COST OF BUILDINGS FROM 250 W TO 50 KW



Results of the Survey of American

ITEMS OF SURVEY		250 WATT AM—FM	1 KW AM—FM	3 KW FM	5 KW AM	10 KW FM	50 KW AM	50 KW FM
1. Location of Transmitter								
(a) In its own building		88%	89%	53%	96%	90%	100%	92%
(b) In office or other building		12%	11%	47%	4%	10%	—	8%
(a) In city		20%	18%	47%	4%	21%	—	7%
(b) Edge of city		68%	48%	20%	35%	51%	6%	50%
(c) Country		12%	34%	33%	61%	28%	94%	43%
(a) Percent having separate transmitter building		49%	86%	74%	96%	79%	100%	100%
(b) Percent having combination studio-transmitter building		51%	14%	26%	4%	21%	—	—
Average distance between transmitter and studios		.9 mile	3.4 miles	5.3 miles	7.7 miles	5.8 miles	13.4 miles	14.5 miles
2. Year Building was Constructed								
(a) 1947		16%	41%	12%	7%	37%	3%	42%
(b) 1946		32%	24%	16%	6%	22%	10%	—
(c) 1940-45		21%	16%	32%	44%	22%	47%	33%
(d) 1935-39		23%	7%	24%*	36%	16%*	23%	17%*
(e) 1930-34		3%	5%	—	4%	3%*	17%	—
(f) Before 1930		5%	7%	16%*	3%	—	—	8%*
3. Type of Architecture								
(a) Contemporary		52%	51%	72%	65%	77%	59%	50%
(b) Traditional		5%	7%	—	15%	15%	13%	8%
(c) Other		43%	42%	28%	20%	8%	28%	42%
4. Type of Construction								
(a) Brick		23%	19%	50%	36%	32%	69%	80%
(b) Wood		40%	21%	4%	6%	7%	6%	—
(c) Concrete		25%	31%	35%	22%	29%	16%	20%
(d) Cinder Block, Prefabricated or other		12%	29%	11%	36%	32%	9%	—
5. Basement, percent of buildings having								
(a) One		26%	26%	53%	51%	35%	56%	43%
6. Total Number of Floors (excluding basement)								
(a) One		86%	92%	75%	85%	73%	60%	46%
(b) Two or more		14%	8%	25%	15%	27%	40%	54%
7. Use waste transmitter heat to heat building areas, percent								
(a) One		47%	50%	67%	71%	70%	65%	83%
8. Landscaping grounds, average cost		\$670	\$935	\$2200	\$1400	\$1400	\$2350	\$1700
9. Land for building and towers, average area — acres		6	15.3	24.5	45	24	47.5	45.3
10. Visitors to transmitter building, average number per week		95	88	96	15	30	11	18
11. Auto Parking Area								
(a) Percent having		71%	65%	80%	80%	84%	89%	64%
(b) Average size		5000 sq.ft.	2280 sq.ft.	2500 sq.ft.	3400 sq.ft.	2600 sq.ft.	2880 sq.ft.	1170 sq.ft.

Broadcast Transmitter Buildings

12. Station Call Sign displayed prominently on building; percent (a) Unilluminated (b) Incandescent illuminated (c) Neon illuminated	250 WATT AM—FM			1 KW AM—FM		3 KW FM		5 KW AM		10 KW FM		50 KW AM		50 KW FM		50 KW FM	
	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	65%	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	Transmitter Building Only	Comb. Transmitter-Studio Bldg.	Transmitter Building Only	Comb. Transmitter-Studio Bldg.
13. Average Cubic Volume of Buildings	5300 cu.ft.	19,100 cu.ft.	65%	7200 cu.ft.	21,000 cu.ft.	17,600 cu.ft.	30,500 cu.ft.	20,600 cu.ft.	30,800 cu.ft.	51,000 cu.ft.	57,400 cu.ft.	39,100 cu.ft.	57,400 cu.ft.	51,000 cu.ft.	57,400 cu.ft.	39,100 cu.ft.	57,400 cu.ft.
14. Building Facilities																	
Office space																	
(a) percent having	26%	86%	31%	25%	78%	35%	63%	44%	39%	100%	78%	71%	78%	100%	78%	71%	78%
(b) average size	260 sq.ft.	540 sq.ft.	24%	227 sq.ft.	1002 sq.ft.	697 sq.ft.	460 sq.ft.	205 sq.ft.	130 sq.ft.	1274 sq.ft.	168 sq.ft.	461 sq.ft.	168 sq.ft.	1274 sq.ft.	168 sq.ft.	461 sq.ft.	168 sq.ft.
Studio space																	
(a) percent having	25%	100%	33%	14%	100%	18%	100%	23%	26%	100%	16%	21%	16%	100%	16%	21%	16%
(b) average size	317 sq.ft.	508 sq.ft.	46%	255 sq.ft.	914 sq.ft.	136 sq.ft.	1667 sq.ft.	227 sq.ft.	135 sq.ft.	1000 sq.ft.	135 sq.ft.	555 sq.ft.	135 sq.ft.	1000 sq.ft.	135 sq.ft.	555 sq.ft.	135 sq.ft.
Storage space																	
(a) percent having	71%	71%	21%	53%	74%	78%	100%	78%	70%	100%	88%	86%	88%	100%	88%	86%	88%
(b) average size	195 sq.ft.	246 sq.ft.		147 sq.ft.	338 sq.ft.	259 sq.ft.	270 sq.ft.	519 sq.ft.	300 sq.ft.	376 sq.ft.	606 sq.ft.	966 sq.ft.	606 sq.ft.	376 sq.ft.	606 sq.ft.	966 sq.ft.	606 sq.ft.
Workshop																	
(a) percent having	78%	72%	21%	81%	79%	75%	75%	88%	91%	100%	94%	93%	94%	100%	94%	93%	94%
(b) average size	124 sq.ft.	142 sq.ft.		125 sq.ft.	163 sq.ft.	190 sq.ft.	263 sq.ft.	191 sq.ft.	236 sq.ft.	202 sq.ft.	278 sq.ft.	320 sq.ft.	278 sq.ft.	202 sq.ft.	278 sq.ft.	320 sq.ft.	278 sq.ft.
Garage																	
(a) percent having	18%	9%	21%	21%	400 sq.ft.	43%	200 sq.ft.	59%	39%	40%	81%	64%	81%	40%	559 sq.ft.	452 sq.ft.	559 sq.ft.
(b) average size	258 sq.ft.	551 sq.ft.		240 sq.ft.	700 sq.ft.	397 sq.ft.	200 sq.ft.	319 sq.ft.	496 sq.ft.	350 sq.ft.	559 sq.ft.	452 sq.ft.	559 sq.ft.	350 sq.ft.	559 sq.ft.	452 sq.ft.	559 sq.ft.
Sleeping quarters																	
(a) percent having	26%	21%	26%	26%	125 sq.ft.	52%	58 sq.ft.	54%	39%	—	47%	64%	47%	—	403 sq.ft.	194 sq.ft.	403 sq.ft.
(b) average size	122 sq.ft.	178 sq.ft.		200 sq.ft.	900 sq.ft.	304 sq.ft.	58 sq.ft.	162 sq.ft.	260 sq.ft.	—	403 sq.ft.	194 sq.ft.	403 sq.ft.	—	403 sq.ft.	194 sq.ft.	403 sq.ft.
Kitchen																	
(a) percent having	11%	15%	11%	26%	101 sq.ft.	52%	58 sq.ft.	54%	52%	20%	81%	57%	81%	20%	146 sq.ft.	74 sq.ft.	81%
(b) average size	79 sq.ft.	128 sq.ft.		65 sq.ft.	101 sq.ft.	116 sq.ft.	58 sq.ft.	102 sq.ft.	73 sq.ft.	240 sq.ft.	146 sq.ft.	74 sq.ft.	146 sq.ft.	240 sq.ft.	146 sq.ft.	74 sq.ft.	146 sq.ft.
Shower Room																	
(a) percent having	33%	23%	33%	30%	13%	48%	38%	64%	78%	—	84%	93%	84%	—	62 sq.ft.	88 sq.ft.	84%
(b) average size	32 sq.ft.	40 sq.ft.		39 sq.ft.	62 sq.ft.	48 sq.ft.	26 sq.ft.	39 sq.ft.	51 sq.ft.	—	62 sq.ft.	88 sq.ft.	62 sq.ft.	—	62 sq.ft.	88 sq.ft.	62 sq.ft.
Employees' Lounge																	
(a) percent having	12%	31%	12%	7%	30%	13%	25%	10%	2%	60%	16%	21%	16%	60%	332 sq.ft.	121 sq.ft.	60%
(b) average size	49 sq.ft.	108 sq.ft.		95 sq.ft.	160 sq.ft.	190 sq.ft.	—	109 sq.ft.	208 sq.ft.	332 sq.ft.	380 sq.ft.	121 sq.ft.	380 sq.ft.	332 sq.ft.	380 sq.ft.	121 sq.ft.	332 sq.ft.
Visitors' Lounge																	
(a) percent having	13%	49%	13%	9%	74%	22%	25%	10%	22%	100%	31%	—	31%	100%	238 sq.ft.	—	100%
(b) average size	153 sq.ft.	257 sq.ft.		99 sq.ft.	360 sq.ft.	188 sq.ft.	—	114 sq.ft.	152 sq.ft.	238 sq.ft.	240 sq.ft.	—	240 sq.ft.	238 sq.ft.	240 sq.ft.	—	238 sq.ft.
15. Cost of Buildings (excluding land and equipment)																	
(a) Average cost	\$3700	\$13,200		\$6600	\$15,300	\$10,700	\$36,500	\$17,000	\$22,700	\$46,300	\$40,300	\$43,200	\$40,300	\$46,300	\$40,300	\$43,200	\$40,300
(b) Average cost per cubic foot	.70	.69		.91	.73	.61	1.12	.82	.74	.91	.70	1.10	.70	.91	.70	1.10	.70

(The figures below cover whole period of construction going back to 1930 and are thus lower than prices prevailing at the present time.)

SECTION IV

Six Outstanding Buildings of Today



250W AM & 3KW FM

KGBS

HARLINGEN, TEXAS

COMBINATION TRANSMITTER-STUDIO BUILDING

OWNER—Harbenito Broadcasting Co. GEN'L MGR.—Troy McDaniel.
CHIEF ENG.—W. O. Porter. ARCHITECT—Newell Waters. CONTRACTOR—Hugh Ramsey. BUILT—1941. BASEMENT—No. NO. FLOORS—1.

FEATURES

Single control room has view of three studios. Separate rooms for AM and FM transmitters. Transmitting equipment, service areas and work shop concentrated in one wing.

CONSTRUCTION OUTLINE

FOUNDATION—Reinforced concrete. STRUCTURAL MATERIAL—Brick and tile. ROOF—Composition. INSULATION—Rockwool. WINDOWS—Steel sash. HEATING AND AIR CONDITIONING—York.

EQUIPMENT OUTLINE

TRANSMITTERS—250 watt AM and 3 KW FM. ANTENNA—425'. EMERGENCY POWER—None. WIRING RUN—Steel conduit.



Offices and studios open off the entrance lobby.





EQUIPMENT KEY

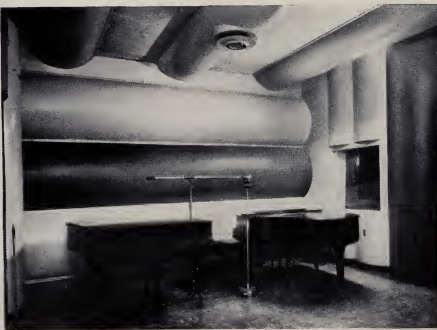
A—250 Watt AM Transmitter

B—3 KW FM Transmitter

250 watt AM transmitter set in wall.



Programs are reproduced in the station manager's office.



Polycylindrical wall treatment is used in large studio.



General office and reception lobby are combined in this ample room. Note visitors' studio viewing window at left.

1 KW AM & 1 KW FM, KSJO

SAN JOSE, CALIFORNIA

COMBINATION TRANSMITTER-STUDIO BUILDING

OWNER—Santa Clara Broadcasting Co., Inc. GEN'L MGR.—Donald H. Telford. ENG. DIRECTOR—John G. Bauriedel. CHIEF ENG.—Larry King. ARCHITECTS—Austin, Field, Fry and Criz. CONTRACTOR—Earl W. Heple. BUILT—1946. BASEMENT—No. NO. FLOORS—1.

FEATURES

Single control room serves two studios, news room, and reception lobby. Work shop and storage combined with transmitter room. Large general office has full glass wall far exterior light. Auxiliary studio viewing from reception lobby.

CONSTRUCTION OUTLINE

FOUNDATION — Concrete. STRUCTURAL MATERIAL — Concrete block. ROOF—Campositan. INSULATION—Rackwool. WINDOWS —Steel sash. HEATING AND AIR CONDITIONING—Gas-fired hot and cold unit.

EQUIPMENT OUTLINE

TRANSMITTERS—1 KW AM and 1 KW FM. PHASING EQUIPMENT —Yes. TRANSMITTER ROOM COOLING AND AIR FILTERING—Sebastopal. ANTENNAS—Vertical uniform cross section, 3 sets of guys. EMERGENCY POWER—None. WIRING RUN—Trench.

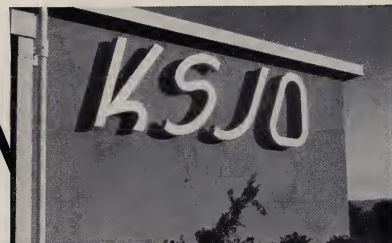


EQUIPMENT KEY

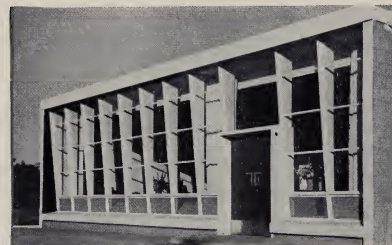
A—1 KW AM Transmitter
B—Audio and Test Equipment
C—1 KW FM Transmitter



Transmitters, all audio controls in this room.



Decorative call letters are neon-illuminated.



Glass front has overhang to control sunlight.

1 KW FM, KP FM PORTLAND, OREGON

COMBINATION STUDIO- TRANSMITTER BUILDING

Right—Large office has a 6 x 10 foot "thermopane" window and wall of glass blocks.



OWNER—Broadcasters Oregon, Ltd. GEN'L MGR.—S. M. Goord. CHIEF ENG.—Walter M. Nelson. ARCHITECT—Donald Byers. CONTRACTOR—G. Edgar Swon. BUILT—1946. BASEMENT—Yes. NUMBER FLOORS—1.

FEATURES

Simple, functional building designed for maximum utilization of space. Employees' lounge in basement. Large picture windows and use of glass block assure maximum natural light. Ample space in transmitter and control room allows for expansion to 10 KW power.

CONSTRUCTION OUTLINE

FOUNDATION—Reinforced concrete. STRUCTURAL MATERIAL—Concrete. ROOF—Built-up, class B composition. INSULATION—2" fiberglas. WINDOWS—Thermopane. HEATING—Hot air, oil burner.

EQUIPMENT OUTLINE

TRANSMITTER—1 KW FM. ANTENNA—Slotted cylinder (temporary). TRANSMISSION LINE—1½". EMERGENCY POWER—None. WIRING RUN—Trough and conduit.



Above—Studio control area of transmitter and control room. Operator seated at the built-in desk in background has a view of both studios.

Top—1 KW Frequency Modulation Transmitter.



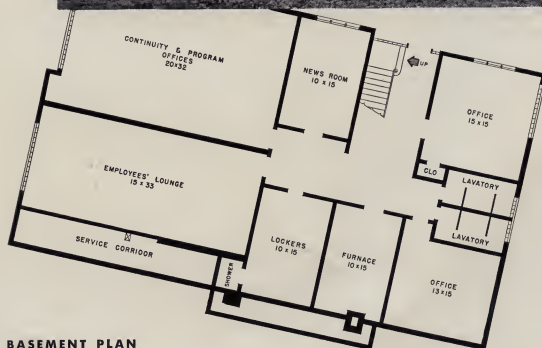
Entrance and reception room. Sound lock leading to studios is at right.

FIRST FLOOR PLAN



EQUIPMENT KEY

- A — 1 KW FM Transmitter
- B — Audio and Test Equipment
- C — Audio and Test Equipment



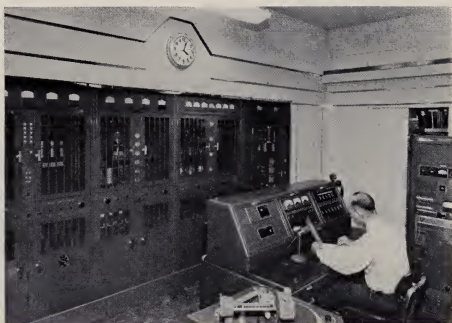
BASEMENT PLAN

Building is located on mountain-top just outside the city limits, two miles from business district.

5 KW AM, KTAR

PHOENIX, ARIZONA

A chain link fence in transmitter room keeps personnel away from high voltage equipment.



Control room, showing 5 KW AM transmitter, antenna control unit, control desk, and audio equipment at right.

OWNER—KTAR Bcstg. Co. GEN'L MGR.—Richard O. Lewis. CHIEF ENGR.—Arthur C. Anderson. ARCHITECTS—Gilmore & Ekman. CONTRACTOR—Hugh Meadows. BUILT—1941. BASEMENT—Excavated area for conduits and transmission lines. NO. FLOORS—1.

FEATURES

Viewing lobby, separated by glass partition from control room. Basement under equipment, with all main conduits and transmission lines in open. Entire building completely bonded, with parallel 2" copper strips each 2 feet under roofing, bonded to 6" copper strips at each corner. All conduits bonded with 2" copper strips and all grounds connected to 6" copper strips extending to main antenna ground screen.

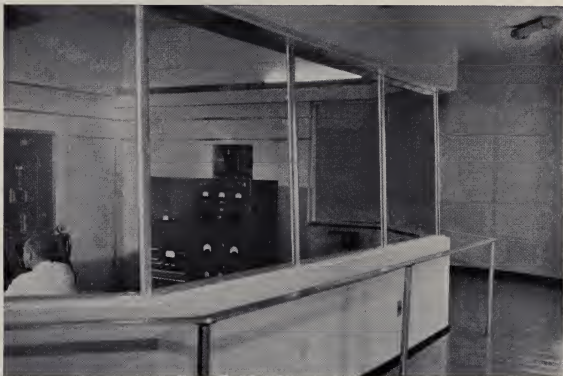
CONSTRUCTION OUTLINE

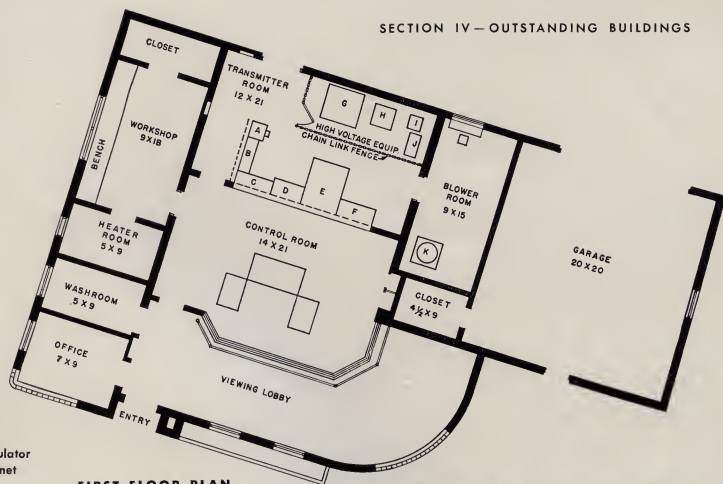
FOUNDATION — Reinforced concrete. STRUCTURAL MATERIAL — Brick. ROOF — Asbestos built-up. INSULATION — Rockwool and acoustical celotex. WINDOWS—Fenestra steel frame. HEATING—Central system with ducts, butane gas. AIR CONDITIONING—Self-contained, 2-3 ton mechanical refrigeration system.

EQUIPMENT OUTLINE

TRANSMITTER—5 KW AM. ANTENNA CONTROL EQUIPT.—Yes. ANTENNAS—2 self-supporting. TRANSMISSION LINE— $7\frac{1}{2}$ ". EMERGENCY POWER—Butane gas engine-driven generator, $37\frac{1}{2}$ KVA, 22 V, 3 phase, automatic. WIRING RUN—Basement under equipment with all main conduits and transmission lines in open.

Public viewing lobby is separated from the transmitter control room by glass panels.

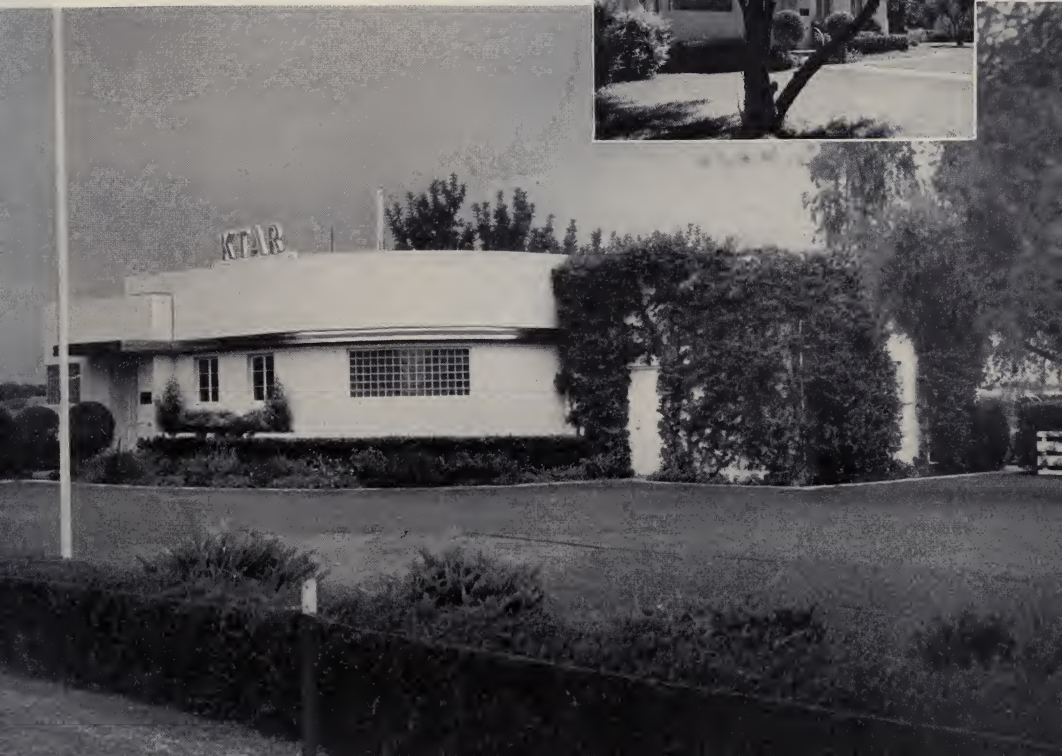




EQUIPMENT KEY

- A—Automatic Voltage Regulator
- B—Power Distribution Cabinet
- C—Control Unit
- D—Oscillator Amplifier
- E—Power Amplifier
- F—Antenna Control Equipment
- G—Rectifier
- H—High Voltage Transformer
- I—Retardation Coil
- J—Filter Condenser
- K—Water Storage Tank

FIRST FLOOR PLAN



5 KW AM WIOD

MIAMI, FLORIDA



OWNER — Isle of Dreams Broadcasting Corp. GEN'L MGR. — James M. LeGate. CHIEF ENG. — M. C. Scott, Jr. ARCHITECT — Robert L. Weed. CONTRACTOR — J. Y. Gooch Co. BUILT — 1940. BASEMENT — No. NO. FLOORS — 2.

FEATURES

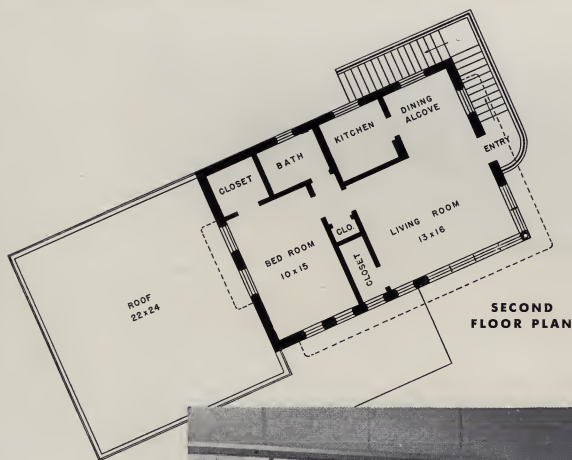
Island Location in Biscayne Bay. Complete living quarters on second floor. Operators' lounge with kitchenette, adjacent to operating room. Large, well-lighted work shop. Room for gasoline engine-driven emergency generator connected to, but not a part of, main building. Compact operating and transmitter rooms.

CONSTRUCTION OUTLINE

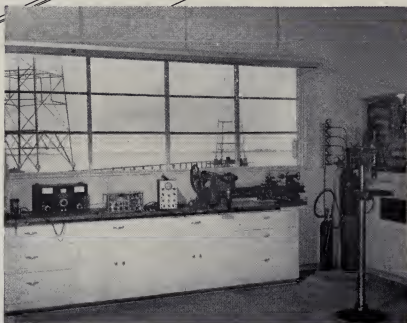
FOUNDATION — Concrete piling. STRUCTURAL MATERIAL — Poured concrete and concrete block. ROOF — Concrete slab. INSULATION — None. WINDOWS — Non-opening, in wood frame. HEATING — Small portable heaters only. AIR CONDITIONING — Forced air ventilation by centrifugal blowers.

EQUIPMENT OUTLINE

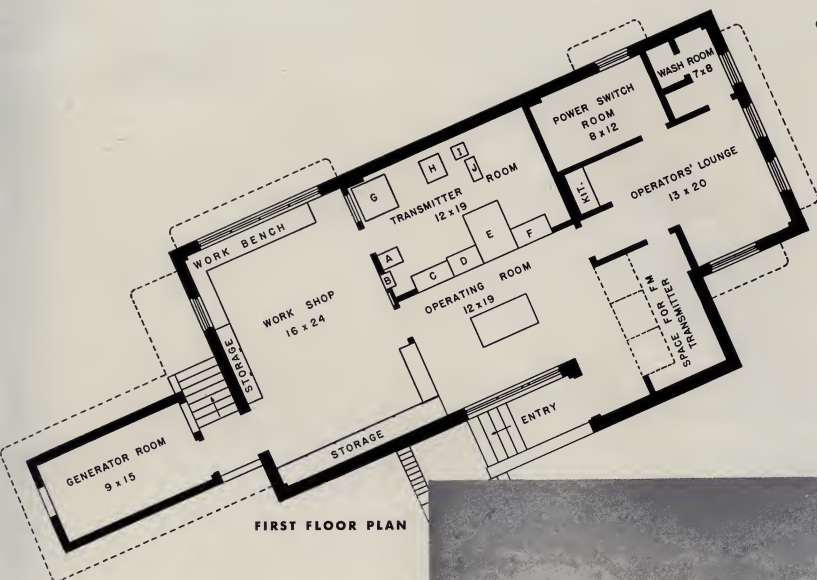
TRANSMITTER — 5 KW AM; 10 KW FM to be installed. TRANSMITTER ROOM COOLING — Centrifugal blowers. AIR FILTERING — Spun glass filters. ANTENNAS — 2-300' self-supporting. TRANSMISSION LINE — $\frac{3}{4}$ ". EMERGENCY POWER — 63 KVA, 230 V, 3 phase, 3 wire, driven by 105 HP gasoline engine with fully automatic start and switch. WIRING RUN — Tubular conduit with square floor duct.



Below, left—Spacious work shop, adjacent to transmitter. Below—Transmitter room. Ceiling furred down to a point above the equipment, to form a recess for lighting cove.



SECTION IV
OUTSTANDING BUILDINGS



FIRST FLOOR PLAN

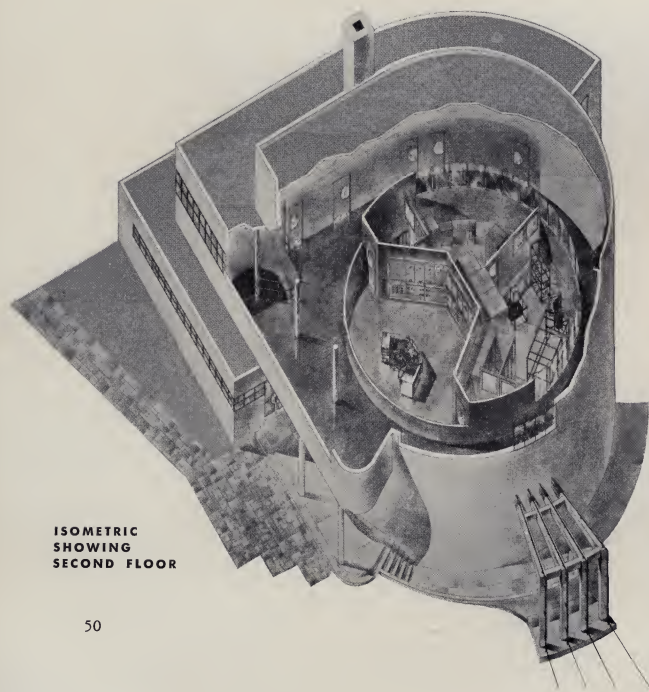
EQUIPMENT KEY

- A—Automatic Voltage Regulator
- B—Power Distribution Cabinet
- C—Control Unit
- D—Oscillator Amplifier
- E—Power Amplifier
- F—Antenna Control Equipment
- G—Rectifier
- H—High Voltage Transformer
- I—Retardation Coil
- J—Filter Condenser

Excellent ground conductivity and easy access to mainland by causeway are assets of WIOD's island location.

Living room of complete apartment on second floor.





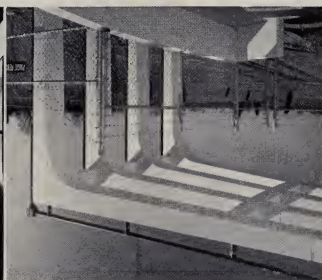
ISOMETRIC
SHOWING
SECOND FLOOR

50 KW AM W T O P

WASHINGTON, D. C.



Electric kitchenette in apartment.



Control room and front of transmitter as seen from observation promenade.



TRANSWITTER—50 KW AM. ANTENNA CONTROL EQUIP.—Yes.
ANTENNAS—3-340', triangular uniform cross section. TRANSMIS-
SION LINES—2½". EMERGENCY POWER—94 KVA, gas engine-
driven. WIRING RUN—Metal duct.

EQUIPMENT OUTLINE

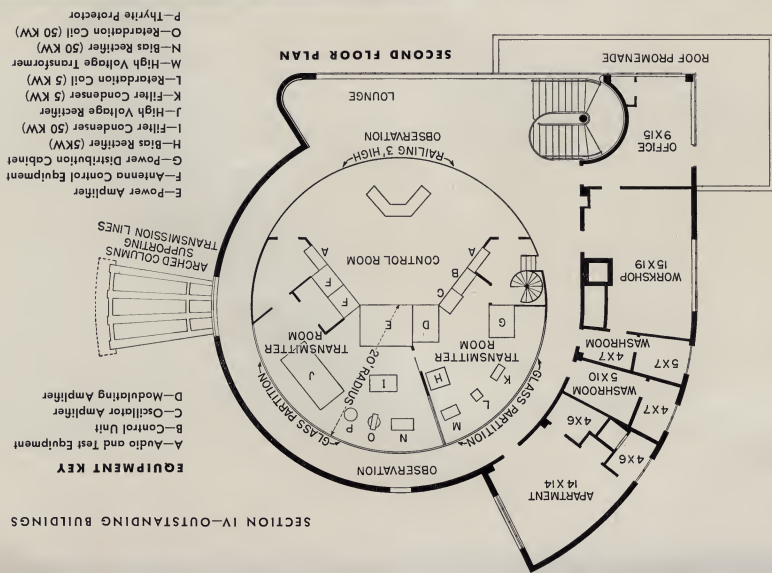
FOUNDATION—Reinforced concrete.
ROOF—Built-up, INSULATION—Gypsum tile.
WINDOWS—Steel casement, HEATING—Hot water system. AIR
CONDITIONING—Refrigeration system for operating personnel
area; humidity-controlled filtered air for entire building.

CONSTRUCTION OUTLINE

Circular observation promenade surrounding transmitter and control rooms allows visitors to view all units of transmitting equipment while station is on the air. Arched columns serve as attractive supports for transmission lines leaving building.

FEATURES

OWNER—Columbia Broadcasting System, Inc. GEN'L MGR.—Carl J. Burkard, CHIEF ENG.—Clyde M. Hunt, ARCHITECT—E. Burton Corning. CONTRACTOR—George C. Martin, BUILT—1940. BASEMENT—NO. NO. FLOORS—2. FIRST FLOOR—Garage, transformer vaults and service areas. SECOND FLOOR—See floor plan.



SECTION IV-OUTSTANDING BUILDINGS

Section V—The Face of the American



250 W WKBR, Manchester, N. H.



250 W WSOC, Charlotte, N. C.



1 KW KFXJ, Grand Junction, Colo.



1 KW KRSC, Seattle, Wash.



5 KW WIP, Philadelphia, Pa.



5 KW KHJ, Los Angeles, Calif.

Transmitter Building



250 W KTUC, Tucson, Ariz.



250 W KRE, Berkeley, Calif.



1 KW KOY, Phoenix, Ariz.



5 KW WSPD, Toledo, Ohio



5 KW WHEC, Rochester, N. Y.



5 KW WRNL, Richmond, Va.



5 KW **WOW, Omaha, Nebr.**



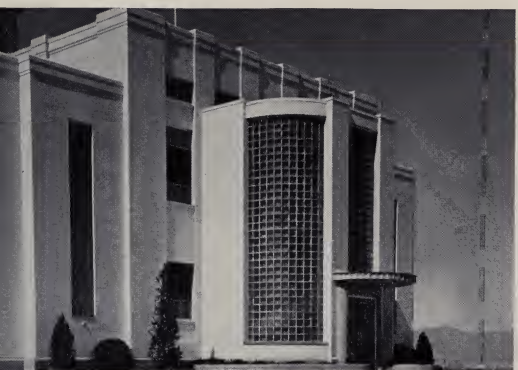
10 KW FM **WNBF-FM, Binghamton, N. Y.**



50 KW **KFAB, Omaha, Nebr.**



50 KW **KIRO, Seattle, Wash.**



50 KW **KSL, Salt Lake City, Utah**



50 KW FM **WKY-FM, Oklahoma City, Okla.**



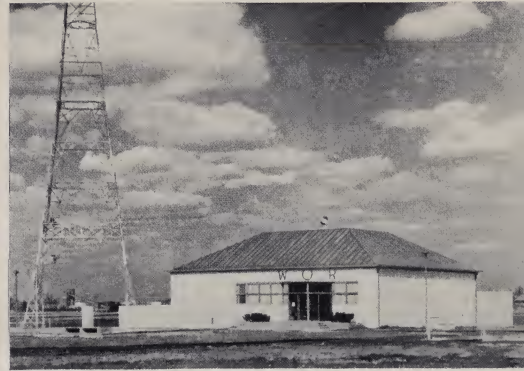
50 KW WHAS, Louisville, Ky.



50 KW WOAI, San Antonio, Tex.



50 KW KNX, Los Angeles, Calif.



50 KW WOR, New York, N. Y.



50 KW WBZ, Boston, Mass.



50 KW KSTP, St. Paul, Minn.

WESTERN ELECTRIC AM

...Specified in Original Building

250 W AM

CODE NUMBER—451A-1 Radio Transmitting Equipment.

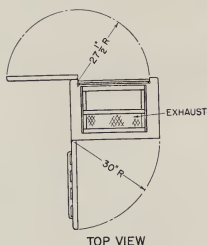
FREQUENCY RANGE—540 to 2750 kilocycles. Any specified frequency in this range.

POWER OUTPUT—250 watts.

PRIMARY POWER SUPPLY—200 to 240 volts, 60 cycles, single phase. (Can also be furnished for 50 cycles.)

WEIGHT—Approximately 1000 pounds.

SEE PAGES 23-25 FOR ORIGINAL PLANS OF BUILDING TO HOUSE THIS TRANSMITTER.



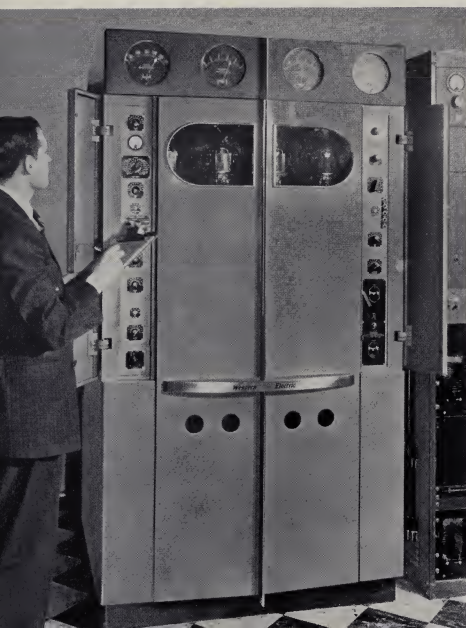
TOP VIEW



SIDE VIEW



FRONT VIEW



CODE NUMBER—443A-1 Radio Transmitting Equipment.

FREQUENCY RANGE—540 to 2500 kilocycles. Any specified frequency in this range.

POWER OUTPUT—1000 watts. (500 watts—442A-1.)

PRIMARY POWER SUPPLY—187 to 250 volts, 60 cycles, single phase. (Can also be furnished for 50 cycles.)

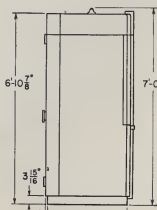
WEIGHT—Approximately 2000 pounds.

SEE PAGES 28-29 FOR ORIGINAL PLANS OF BUILDING TO HOUSE THIS TRANSMITTER.

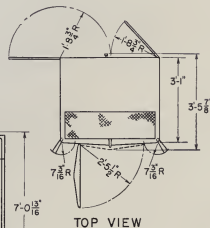
1 KW AM



FRONT VIEW



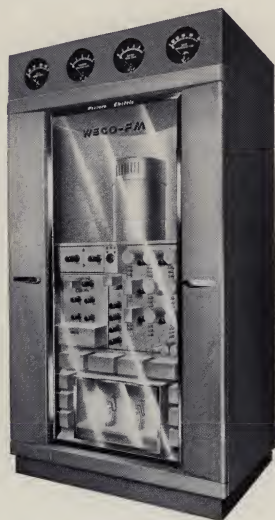
SIDE VIEW



TOP VIEW

AND FM TRANSMITTERS

Plans in Section II, Pages 23-35



CODE NUMBER—501C-2 Radio Transmitting Equipment.

250 W FM

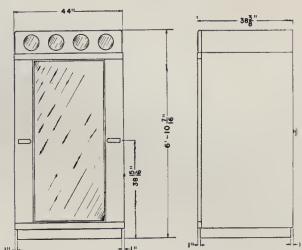
FREQUENCY RANGE—88 to 108 megacycles. Any specified frequency in this range.

POWER OUTPUT—250 watts.

PRIMARY POWER SUPPLY—187 to 250 volts, 60 cycles, single phase. (Can also be furnished for 50 cycles.)

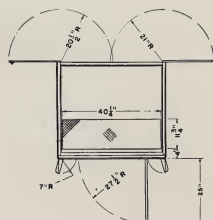
WEIGHT—Approximately 1000 pounds.

SEE PAGES 26-27 FOR ORIGINAL PLANS OF OFFICE BUILDING LAYOUT FOR THIS TRANSMITTER.



FRONT VIEW

SIDE VIEW



TOP VIEW

1 KW FM

CODE NUMBER—503B-2 Radio Transmitting Equipment.

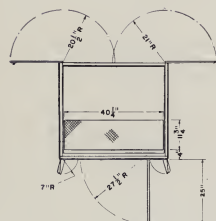
FREQUENCY RANGE—88 to 108 megacycles. Any specified frequency in this range.

POWER OUTPUT—1000 watts.

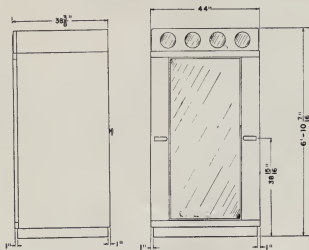
PRIMARY POWER SUPPLY—208 to 230 volts, 60 cycles, single phase. (Can also be furnished for 50 cycles.)

WEIGHT—Approximately 1500 pounds.

SEE PAGES 30-31 FOR ORIGINAL PLANS OF BUILDING TO HOUSE THIS TRANSMITTER.

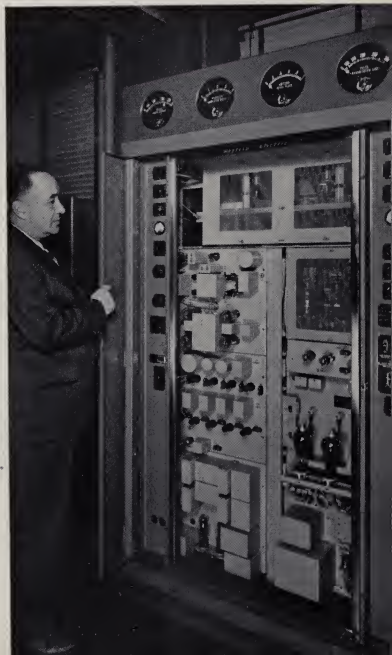


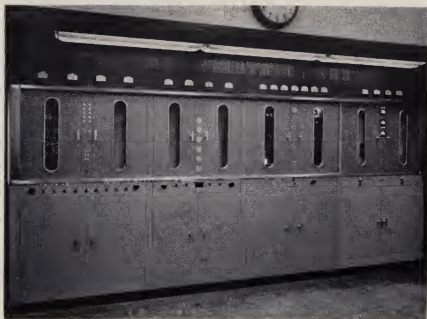
TOP VIEW



SIDE VIEW

FRONT VIEW





5 KW AM

CODE NUMBER—405B-2 Radio Transmitting Equipment.

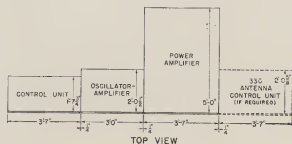
FREQUENCY RANGE—550 to 1600 kilocycles. Any specified frequency in this range.

POWER OUTPUT—5000 watts. Power reduction by push button control to 2500 or 1000 watts, as adjusted.

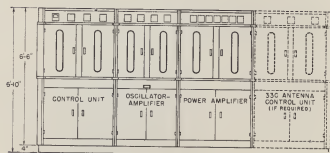
PRIMARY POWER SUPPLY—210 to 250 volts, 60 cycles, 3 phase. (Can also be furnished for 50 cycles.)

WEIGHT—Approximately 8900 pounds, including all accessories.

SEE PAGES 32-33 FOR ORIGINAL PLANS OF BUILDING TO HOUSE THIS TRANSMITTER.



TOP VIEW



FRONT VIEW

50 KW AM

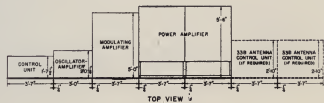
CODE NUMBER—407A-1 Radio Transmitting Equipment.

FREQUENCY RANGE—540 to 1600 kilocycles. Any specified frequency in this range.

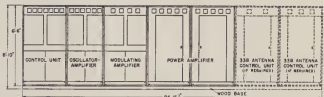
POWER OUTPUT—50 kilowatts.

PRIMARY POWER SUPPLY—460 volts, 60 cycles, 3 phase. (Can also be furnished for 50 cycles.)

WEIGHT—Approximately 27,000 pounds, including all accessories.



TOP VIEW



FRONT VIEW

3 KW FM

CODE NUMBER—504B-2 Radio Transmitting Equipment.

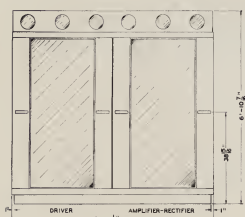
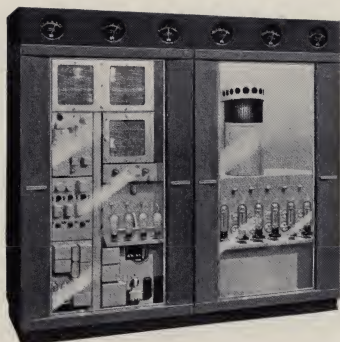
FREQUENCY RANGE—88 to 108 megacycles. Any specified frequency in this range.

POWER OUTPUT—3000 watts.

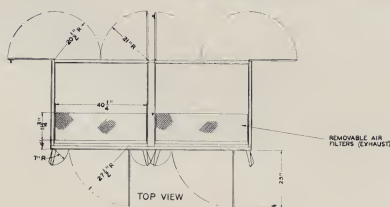
PRIMARY POWER SUPPLY—208 to 230 volts, 60 cycles, 3 phase. (Can also be furnished for 50 cycles.)

WEIGHT—Approximately 3700 pounds.

SEE PAGES 30-31 FOR ORIGINAL PLANS OF BUILDING TO HOUSE THIS TRANSMITTER.



FRONT VIEW



TOP VIEW

10 KW FM

CODE NUMBER—506B-2 Radio Transmitting Equipment.

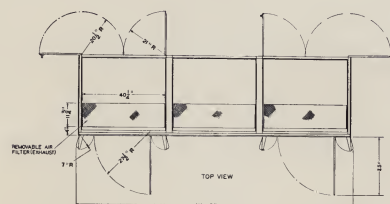
FREQUENCY RANGE—88 to 108 megacycles. Any specified frequency in this range.

POWER OUTPUT—10,000 watts.

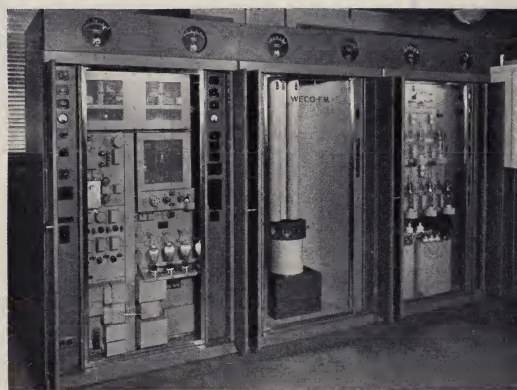
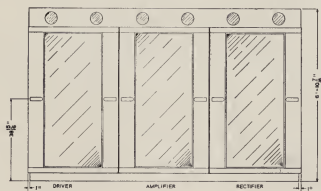
PRIMARY POWER SUPPLY—208 to 230 volts, 60 cycles, 3 phase. (Can also be furnished for 50 cycles.)

WEIGHT—Approximately 5700 pounds.

SEE PAGES 30-31 FOR ORIGINAL PLANS OF BUILDING TO HOUSE THIS TRANSMITTER.



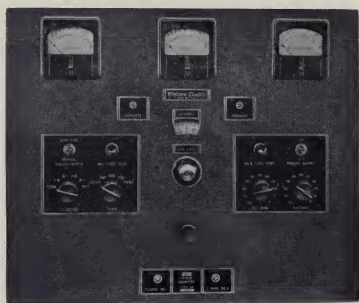
TOP VIEW



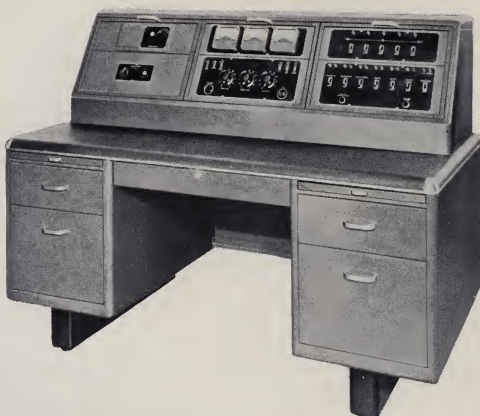
AUXILIARY



**5A FREQUENCY AND MODULATION
MONITOR FOR FM**

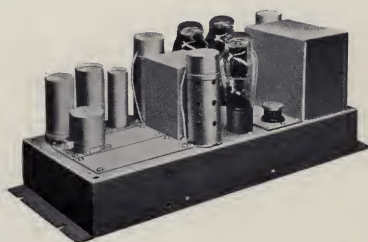
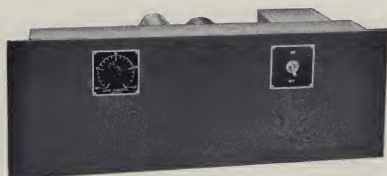


2A PHASE MONITOR



**TRANSMITTER CONTROL DESKS
FOR 5 AND 50 KW AM TRANSMITTERS**

124E MONITOR AMPLIFIER



EQUIPMENT

5A FREQUENCY AND MODULATION MONITOR FOR FM — Gives continuous indication of transmitter center frequency error; shows level of transmitter modulation up to 140%; has a light that flashes when a selected level of modulation is exceeded.

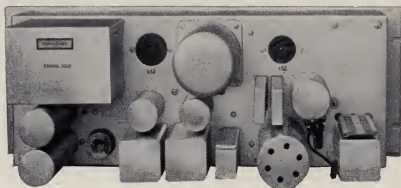
2A PHASE MONITOR — Measures phase and amplitude relations of the currents in the antenna elements of a directional array so that these relations can be correlated with the field pattern.

TRANSMITTER CONTROL DESKS — For 5 KW and 50 KW AM Transmitters. Contain volume indicator panel, monitoring amplifier, meter panel, line and on-announce control panel and power switch panels for controlling transmitter circuits.

124E MONITOR AMPLIFIER — For monitoring AM and FM programs in transmitter buildings and studios. Designed for relay rack mounting. Has a gain control and power switch mounted on the face plate.

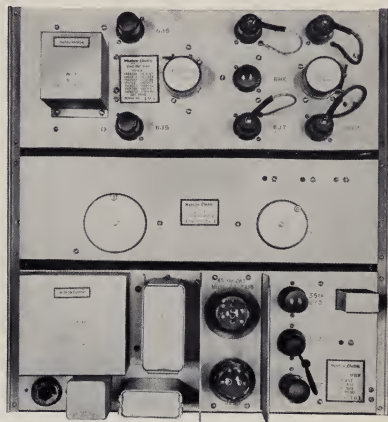
106A LINE AMPLIFIER — For raising the level of programs coming into a transmitter building from the program lines.

1126C PROGRAM OPERATED LEVEL GOVERNING AMPLIFIER — Reduces excessive peaks and protects against over-modulation in AM transmission. Prevents over-swing in FM, which may cause distortion in the receiver and the guard band to be overridden.



106A LINE AMPLIFIER

1126C PROGRAM OPERATED LEVEL GOVERNING AMPLIFIER





GraybaR distributes nationally
Western Electric high quality radio broad-
casting equipment, radio communications
equipment, sound reproduction equip-
ment, and industrial products

PLUS

Blaw-Knox towers, *General Radio* meas-
uring equipment, *Communication Products*
transmission line material

PLUS

All of Broadcasting's needs in lighting, wiring, signalling
and power equipment for station grounds and buildings,
including such items as:

Motors — Electric	Telephone Supplies	Floodlights
Calling & Signalling	Burglar Alarms	Wire & Cable
Systems	Water Coolers	Tape & Tools
Fire Alarms	Fluorescent &	Controllers
Heaters	Incandescent Lighting	Welding Machines
Wiring Devices	Fixtures & Lamps	& Electrodes
Fuses	Ventilators	Relays
Transformers	Switches	Portable Electric
Conduit	Switchboards	Tools
Flashlights	Bells	Batteries
Meters	Fans and Blowers	Insulators
Circuit Breakers		

RADIO ENGINEERING LABORATORIES, Inc.

35-54 THIRTY-SIXTH STREET
LONG ISLAND CITY 1, N. Y.

DESIGN AND MANUFACTURING
SPECIALISTS FOR F M
BROADCAST SERVICE

RELIABLE ENGINEERING LEADERSHIP

January 26, 1949

Radio Station WNYC
Municipal Building
New York, New York

ATT: Mr. Seymour Siegel
General Manager

Dear Mr. Siegel:

Following up our conversation yesterday morning, we are pleased to quote you on our Model 706 FM Educational Broadcast Transmitter.

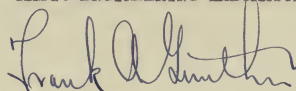
This is priced at \$1,595.00 f.o.b. Long Island City, complete with crystal and one set of tubes. Price of Model 706 Single Ring Antenna is \$25.00. Further accessory items will be announced in the next week or ten days.

Both of these items can be delivered in about four to six weeks and after that we estimate that deliveries can be made virtually immediately.

Very truly yours,

RADIO ENGINEERING LABORATORIES, INC.

(73)



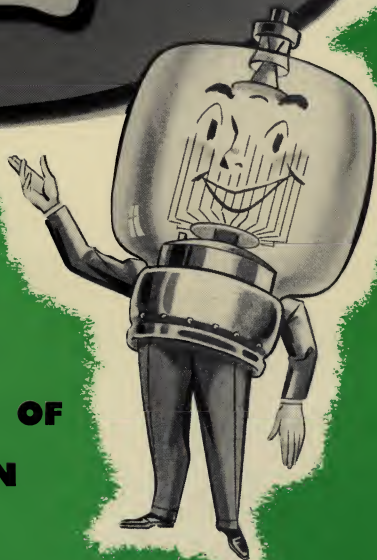
Frank A. Gunther
Vice President

FAG/mlm



BETTER BROADCASTING THROUGH THE CORRECT USE OF FREQUENCY MODULATION

REL



**BETTER BROADCASTING
THROUGH THE CORRECT USE OF
FREQUENCY MODULATION**



Stop, look and listen !

Before you make commitments on any FM Broadcast Transmitter, check the performance record of REL tetrode powered FM Transmitters. These actual case histories of installations in all sections of the country offer convincing evidence of the lower first cost and lower operating cost of REL FM Broadcast Transmitters. They tell, in every instance, an equally important story of maximum operating convenience, negligible maintenance, low tube cost and unmatched dependability. These records provide a new and valuable yardstick for judging FM transmitter costs. If you are interested in applying the REL yardstick to your FM problem, simply call or write today. Complete information will be supplied and visits to operating installations can be arranged.

REL leads the FM field!

Every unit in the REL line has been engineered and built in keeping with the long established tradition of REL *Reliable Engineering Leadership*. This leadership, an acknowledged fact throughout the industry (see inside back cover) is the direct outgrowth of over 14 years of application to the exclusive task of advancing the art of FM transmission and reception. Production of equipment for commercial FM broadcast use is the one and only activity of REL.

REL

REL EDUCATIONAL FM BROADCAST TRANSMITTERMODEL 706

The REL Model 706 10 Watt Educational FM Broadcast Transmitter is a high quality, inexpensive equipment which comes within the budget means of most educational institutions. It exceeds in every detail the exacting performance requirements of the FCC for commercial FM broadcasting and, surpasses by far, the requirements for educational service. Therefore, the Model 706 Transmitter may be used at a later date as an exciter for REL transmitters of higher power in the range from 250 Watts to 50,000 Watts.

This transmitter employs the remarkable SERRASOID MODULATOR, developed and manufactured exclusively by REL. As a result, the overall design is simple and straight-forward, requiring no special tubes or control mechanisms. There are fewer tubes and circuits employed in the REL Model 706 Transmitter than in any other transmitter capable of meeting the educational broadcast requirements. It is the finest equipment of its kind available today.

The entire unit is housed in a rugged aluminum cabinet, and is designed to permit ready accessibility and ease of servicing.

The basic principles used in the design of this transmitter are a result of pioneering FM research on the part of REL, the first manufacturer of FM broadcast equipment in the world.

ECONOMY:

The REL Model 706 Transmitter is outstanding in its economy, because it employs only standard vacuum tubes readily available anywhere. This coupled with its exceptionally low purchase price, results in a substantial saving to the Purchaser.

INSTALLATION:

Installation is a very simple matter. The Model 706 Transmitter is completely tested on the user's operating frequency before shipment and an instruction book is furnished containing detailed directions for installation, operation and maintenance. The entire transmitter when delivered, is ready for immediate operation. Connection to an ordinary AC wall outlet can be made in the conventional manner similar to any electrical appliance. It is easier to install than the average television receiver.

RELIABILITY:

Simple, conservative design employing only the highest quality components, assures the operator of trouble-free stable operation for the life of the equipment. All components are generally available in or near most communities.

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Page (1) of (4)
Date: 12-29-48



ACCESSIBILITY:

All individual chassis in the transmitter are the vertical relay rack type for ready accessibility. All input and output connections are available by means of plugs and jacks located at the rear of the cabinet.

SAFETY:

Safety devices are provided to prevent physical contact with any voltage. Locks are included to prevent access by unauthorized persons.

COVERAGE:

There are many factors that affect the coverage of the broadcast signal from the Model 706 to the average home type FM receiver. Among these factors are antenna height, receiver sensitivity and the nature of the surrounding terrain. However, with a simple transmitting antenna mounted on the average school roof, coverage may vary from a minimum of an average campus area to a maximum area of two to five miles radius.

The Model 706 Transmitter is designed around the new REL SERRASOID MODULATOR*. This invention is destined to play an important part in FM history. The device employs only four simple receiving tubes, and contains no tuned circuits. It, therefore, makes available for the first time a simple and reliable approach to genuine Frequency Modulation transmission. It is interesting to know that the modulator's electrical performance, which determines the quality of the signal that is heard in receivers, is superior by a wide margin to any other system known to the radio art today.

ELECTRICAL SPECIFICATIONS

Operating Frequency:	Any single frequency in the 88 to 108 mc. range.
Center Frequency Stability:	Within plus-minus 1000 cycles over normal room temperature range.
FM Signal to Noise Ratio:	75 db below 100% modulation.
AM Signal to Noise Ratio:	50 db below 100% modulation.
Audio Frequency Distortion:	Less than 0.5% for any single frequency in the 50 to 15,000 cycle band at 100% modulation.

* (SERRASOID MODULATOR) - Electronics,
October 1948.



ELECTRICAL SPECIFICATIONS (Cont'd.)

Audio Frequency Response and Pre-Emphasis:

Standard 75 micro-second pre-emphasis is incorporated in the modulator, and the resulting overall response of the transmitter, including pre-emphasis, lies within 1.0 db of the FCC prescribed limit for 50 to 15,000 cycles. Excluding the affect of pre-emphasis, the response of the transmitter is uniform within 0.5 db from 50 to 15,000 cycles.

Audio Frequency Input:

Plus 10 dbm for 100% modulation, 600 ohms, balanced or unbalanced. A standard type Cannon P-3-14 jack and type T-23 plug is furnished.

Power Output:

10 Watts. The rf power output is designed to operate into a co-axial transmission line of 51.5 ohms surge impedance. Type RG8U Transmission Line may be employed. A standard AN-SO-329 type jack and standard type AN-PL-259 plug is supplied for this purpose.

Primary Power:

115 volts, 50/60 cycles, 1 phase. 185 Watts at 92.5% power factor total is required. *Auto transformer for other primary voltages is available at slight extra cost.*

TUBE COMPLEMENT:

Audio Amplifiers	(1) 6SJ7	Rectifier	(1) 5U4G
	(1) 6J5	Regulators	(1) VR105
Crystal Oscillator	(1) 6AU6		(1) VR150
Shaper	(1) 12AT7	Power Output Indicator	(1) 49 - 2V.06A (Lamp)
Serrasoid Generator	(1) 12AT7		
Gater	(1) 12AT7		
Frequency Multipliers	4 (5) 6AU6		
	3 (2) 12AU7		
Power Output Tubes	(1) 2E26		

MECHANICAL DATA:

The Model 706 Transmitter is housed in a handsome aluminum cabinet, finished in lustrous two-tone green enamel. The four separate panel units contained in the cabinet are designed so that they may be mounted in any standard 19" relay rack, if desired.

Article 9-220
Page (3) of (4)
Date: 12-29-48
Rev: 1-14-49



MECHANICAL DATA (Cont'd.)

Dimension:

		<u>HEIGHT</u>	<u>WIDTH</u>	<u>DEPTH</u>
<u>Net</u>	-	39"	24"	14-1/2"
<u>Gross</u>	-	44"	29"	16-1/2"

Weight:

<u>Net</u>	-	90 pounds.
<u>Gross</u>	-	Packed for Railway Express or Air Freight 145 pounds.

WE RESERVE THE RIGHT TO MAKE ENGINEERING CHANGES

In order to permit improvements in design to be incorporated and to allow for the use of improved manufacturing processes or methods or to realize economies in production, Radio Engineering Laboratories, Inc. reserves the right to change or modify the design of any of its products to any extent in accordance with its sole judgment while adhering in good faith to the intent of these specifications.

Article 9-220
Page (4) of (4)
Date: 12-29-48
REV: 1-18-49



Radio Engineering Laboratories, Inc.
Long Island City, New York
Photo No.

"Model 706, 10 Watt FM Bcst. Trans."
Specifications: Article 9-220

ANSWERS TO QUESTIONS ON F.C.C. FORM 340, INVOLVING REL EQUIPMENT:

22. Facilities requested:

- (a) Channel - _____ kilocycles
 (b) Operating power - 10 watts
 (c) Type of emission - FM.

23. Describe transmitting apparatus proposed to be installed. If more than one transmitter is to be used attach separate description(s) thereof.

- (a) Make REL Type or Model No. 706
 (b) Oscillator: Type of circuit Modified Pierce Number, make and type of tube(s) 1 - Type 6AU6 Normal total plate current 4 milliamperes Plate voltage 250

If additional oscillator is employed to determine carrier frequency give:

Type of circuit Not applicable Number, make and type of tube(s) _____

- (c) Carrier frequency stability: List apparatus included as an integral part of the transmitter for maintaining carrier frequency constant.

Stability within plus-minus .001%, Bliley Electric Co., Type BC46R Crystal Unit.

- (d) List intermediate stages by number and type of tubes in each stage _____

Audio (1) 6SJ7 (1) 6J5 - Modulator (3) 12AT7 - Multipliers (5) 6AU6 (2) 12AU7

- (e) Last radio stage: Number, make and type of tube(s) 1 RCA Type 2E26

Normal operation for power requested: Total plate current .05 Amp.
 Plate voltage 400 volts.

- (f) Which radio stage is modulated? (4) See (d)

- (g) What system of modulation is employed? Phase Shift Type Frequency Modulation

- (h) The transmitter is designed for what maximum percentage of satisfactory modulation? ±100 kilocycles Peak Deviation, 50 - 15,000 cycles.

- (i) Rated output power of transmitter is 10 watts

- (j) Will a pre-emphasis circuit be used in the transmitter by which the higher frequencies will be emphasized in accordance with the impedance-frequency characteristics of a series inductance-resistance circuit having a time constant of _____

Article 9-225
 Page (1) of (2) pages
 January 14, 1949



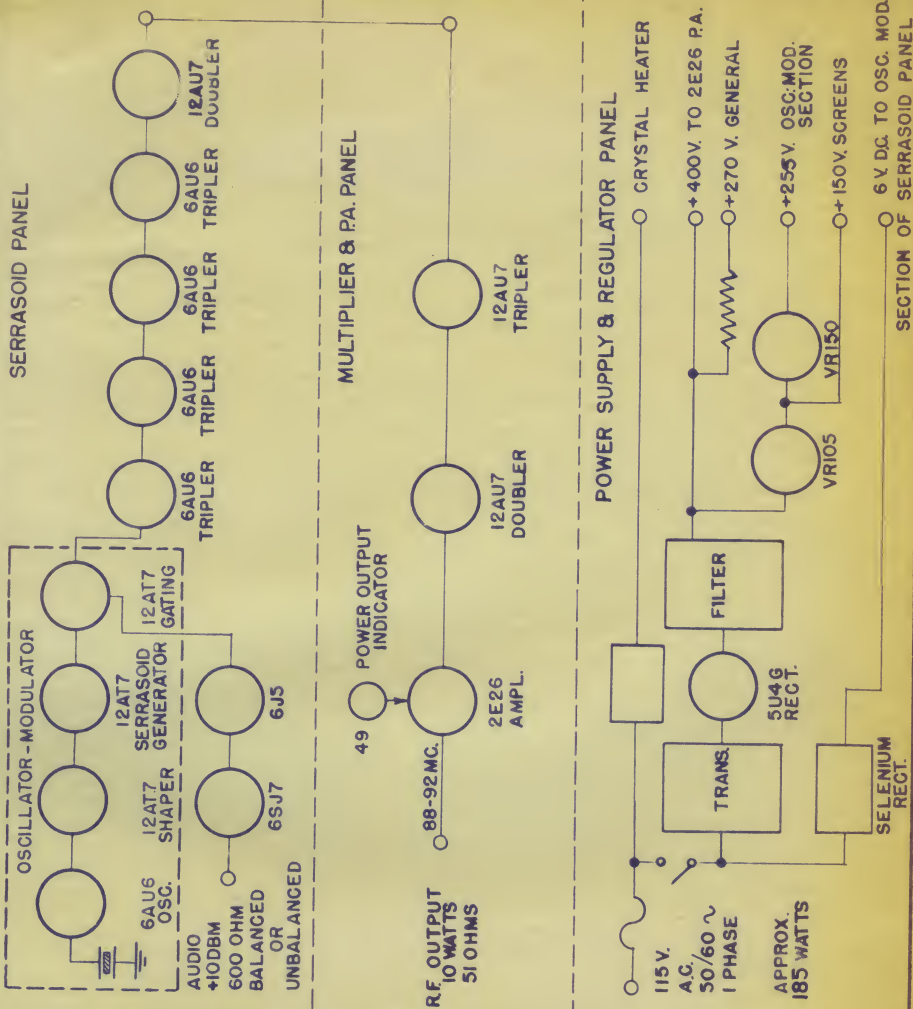
75 microseconds? Yes The frequency characteristics of the transmitter with the pre-emphasis circuit will be within ± 1 decibels of the calculated characteristics of such circuit.

25. Attach accurate schematic diagrams of the fundamental circuit of proposed transmitter (indicating type of tubes) and including antenna system. (Will be furnished by REL.)
26. (a) None required.
27. Give make, type number, and/or describe the modulation monitor or modulation measuring equipment Standard VU meter bridged on transmitter modulation input.
28. Give the following with respect to the proposed antenna system:
 - (a) Type of antenna Single Element Ring
 - (1) Number of elements (bays, etc.) One
 - (2) Make REL
 - (4) Antenna field gain 0.9 (5) Polarization Horizontal
 - (h) Give the following information with respect to the transmission line used to supply power to the antenna from the transmitter:
 - (2) Type No. RGSU
 - (3) Description Vinylite Jacket 50 ohm Flexible Coax Size 1/2"
 - (5) Estimated Efficiency: 2 db. loss per 100 ft.

TOLERANCES UNLESS OTHERWISE SPECIFIED ARE: FRACTIONS:

DECIMALS

ANGLES:



REVISIONS	IN'L	DATE	MODEL 706 BLOCK DIAGRAM	
			DATE: 1 17 49	MATERIAL
			DRAWN BY: M.M.W.	
			APPROVED BY:	
			RADIO ENGINEERING LAB'S. INC. 35-54 36TH ST. LONG ISLAND CITY, N. Y.	SHEET SK 18-51



REL pioneered FM!

- 1935 FIRST TO BUILD FM EQUIPMENT!** REL manufactured the equipment used in the first public demonstration of practical FM transmission.
- 1939 FIRST WITH COMMERCIAL FM!** REL was the first manufacturer to produce and install a commercial FM broadcasting transmitter.
- 1939 FIRST WITH AN FM RELAY!** REL established the first studio to transmitter FM relay ever installed. This equipment is still operating.
- 1940 FIRST WITH 50 KW FM!** REL engineered and built the first commercial FM transmitter rated at 50 KW output.
- 1947 FIRST WITH THE QUADRILINE!** REL Quadriline circuit structure eliminated most RF and mechanical construction problems at the 10 KW level.
- 1947 FIRST WITH AN FM NETWORK!** REL FM equipment was used exclusively to establish the first all-radio-linked FM network. Total length 445 miles.
- 1948 FIRST WITH UHF STL!** REL Model 694 STL equipment freed FM broadcasting from the handicap of inadequate wire line facilities.
- 1948 FIRST WITH THE SERRASOID MODULATOR!** REL introduced the amazingly efficient and economical "SERRASOID MODULATOR" for FM transmitters.

REL

RADIO ENGINEERING LABORATORIES, INC.

35-54 36th STREET • LONG ISLAND CITY, N. Y.



REL

Engineering Representatives

SOUTH-EAST: BIVINS AND CALDWELL

ROOM 807, SECURITY BANK BLDG., HIGH POINT, NO. CAROLINA

GULF COAST: THE MAYRAY COMPANY

1500 CANAL STREET, NEW ORLEANS, LOUISIANA

FLORIDA: ARTHUR H. LYNCH & ASSOCIATES

BOX 466, FORT MYERS, FLORIDA

MID-WEST: R. E. L. EQUIPMENT SALES, INC.

612 NORTH MICHIGAN AVENUE, CHICAGO 11, ILLINOIS

PACIFIC COAST: NORMAN B. NEELY ENTERPRISES

7422 MELROSE AVENUE, HOLLYWOOD 46, CALIFORNIA

OHIO-PENNSYLVANIA: MILLER-SADENWATER

1165 FIFTH AVENUE, NEW YORK, NEW YORK

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A collaboration among the Maryland Institute for Technology in the Humanities,
University of Wisconsin-Madison Department of Communication Arts,
and Wisconsin Historical Society.

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